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MANAGEMENT OF CHRONIC SINUS DISEASE

A CRITICAL ANALYSIS OF MODERN THERAPEUTIC MEASURES

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Successful therapeutic measures are those which spring from a sound knowledge of the anatomy, the physiology and the histopathology of the structures treated.

The earlier rhinologists had no such chart to guide them. This is shown by their apparent disregard for the preservation of functioning structures. They began in 1884, with the discovery of cocaine, to disrupt completely nature's well-organized and capable mechanisms of defense. Many of the technics of those days were designed for the purpose of making the removal of turbinates and other nasal tissues easy, complete and permanent. Mistakes in therapy, however, were eventually recognized by the unsatisfactory clinical results which followed and efforts were made to correct them. The newer methods, however, also failed, for they, too, were devoid of a proper scientific foundation, and for a period of approximately 40 years no satisfactory explanation for the failure of the various methods in common use was

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forthcoming. The result of this was a state of confusion which existed throughout the entire time and which only the fine research and clear thinking of the past few years have been able to dispel.

The period of enlightenment in rhinology began 20 years ago with what Proetz terms, "the rediscovery of the cilia." Most of the investigative work since then has been directed toward a better understanding of the physiological activities of the various structures within the nose.

Certain problems concerning the sinuses still present themselves, but it must be noted that they become less portentous as our knowledge of nasal function becomes more comprehensive.

We have at last come to realize the importance of the role played by the ciliated mucosa and the moving film of mucus covering it. We know now that a constant flow of mucus is usually significant of a healthy nose; that the olfactory nerve ends function when the olfactory mucosa in the upper straits of the nose is immersed in serous fluid; that liquid in large quantities is necessary for the proper preparation of the inspired air which is to pass into the lower air passages, and that the cilia of the respiratory mucosa require a moist medium in which to beat. We realize that the mucus sheet kept in motion by the cilia ensnares and destroys bacteria and in the event of a breakdown in the mucociliary stream, permitting an invasion by pathogenic organisms, an able secondary defense is provided in the subepithelial layers of the nasal and sinus membranes which are capable of carrying on indefinitely.

We have learned to respect the integrity of the turbinates: the inferior, because it regulates the volume of air which passes through the nose and aids in warming and humidifying the inspired air; the ethmoid turbinates, because with their preponderance of glands they contribute liberally to the all important supply of mucus and because of their location they protect the sinus ostia from blasts of inspired air.

The significance of the protection thus afforded is more thoroughly appreciated when it is realized that the cilia, in protected areas, such as on the floor of the nose and on the under surfaces of the turbinates, beat more vigorously than those in exposed positions, such as the anterior face of the turbinates where they are practically inactive. Certainly, if there is any one place in the nose where active cilia are needed it is in the drainage areas of the sinuses.

An analysis of the above observations leads to but one conclusion; to wit, in the treatment of nasal conditions the preservation of

functioning structures is mandatory. Most of the procedures initiated previous to the 1920's called for removal of functioning tissue and this was largely the reason for their failure. Those which did not, such as septal resection and sinus irrigation, have survived. All of the others which have not, as yet, been discontinued now come up for careful scrutiny in the light of our better understanding of the nature of the nasal and sinus cavities.

The removal or destruction of portions of the turbinates, still a thing of common occurrence, is seldom necessary. Inferior turbinates are commonly cauterized because of excessive swelling which, in most instances, is merely a reaction to disease elsewhere. The swelling may be an allergic manifestation or a vasomotor reaction to an endocrine imbalance, a gastrointestinal disturbance or some other systemic condition, or may be traced to sinusitis which causes a congestion of all tissues on the affected side. The swelling, if not due to a proliferative process which is extremely rare, is not a disease but the result of a condition which disappears promptly with the elimination of the cause. If the middle turbinate obstructs sinus drainage it may be pushed medially, or, if it contains a cell, this may be crushed or removed. If a deviated septum prevents sufficient infraction of the turbinate, a submucous resection at least of its impinging portion is indicated. The anterior third of a middle turbinate is often removed under the misguided theory that sinus drainage is thereby aided or that a frontal sinus may thus be more easily probed or irrigated.

The vast amount of information which has been assembled concerning the ciliated membranes has lead to a great improvement in nasal medication. Formerly, a wide variety of medicaments were sprayed, packed or dropped into the nose with little regard for the mucous membranes.

We know now that few drugs may be applied to the respiratory mucosa without causing harm. Ephedrine in saline and similar solutions are effective vasoconstrictors harmless to the cilia, yet their prolonged and promiscuous use is to be discouraged. They afford temporary relief in cases of acute blockage but are of little curative value and should not be relied upon in chronic cases. Sulfonamide solutions with ephedrine are usually alkaline and irritating and the same may be said of the mild silver protein solutions which, in the form of argyrol and neosilvol, have been so widely used as nasal packs. These should be prescribed only by those who feel that application of an irritant is indicated in the treatment of infected sinuses.

Any critical analysis of the methods used in rhinological practice must, of needs, include an inquiry into the cause of our failure in the management of chronic sinus disease.

Evidence of failure is at every hand and this is not difficult to understand. Myriads of articles have appeared advocating various therapeutic measures and reporting clinical cures. Few of the writers seem concerned about why or how the improvement occurs and are merely interested in the success of the method. These articles are misleading, are of no value and merely add to the state of confusion which has always existed. Most of the writers seem to have overlooked the fact that all methods fail which do not aid in the improvement of sinus drainage. Much time has been wasted on palliative measures such as packs, physical therapy and irrigations. These methods are usually ineffective against chronic sinusitis unless, in the meantime, correction of drainage defects is accomplished.

Radical measures are often adopted after a short session with ineffective packs and irrigations. To many surgeons, failure of improvement with a few such treatments implies diseased sinus mucosa beyond hope of repair, which to them is sufficient reason for removal. Another indication is the presence of hyperplastic tissue as revealed by roentgenograms. This condition may be discovered by accident in a patient complaining of only vague symptoms of sinus involvement, yet in the eyes of many it should be removed. These are cases of chronic nonsuppurative sinusitis characterized by a mild puriform discharge—the so-called postnasal drip—and the best that can be hoped for in the removal of the sinus lining is its replacement by one less able to combat infection in a cavity which is quite susceptible to reinfection. The great fault of the surgeons who commonly institute radical procedures in chronic sinusitis is their lack of appreciation of the full capabilities of the membranes they remove.

A proper understanding of the capabilities and other characteristics of these tissues may be determined only by microscopic examination of specimens of sinus mucosa removed at operation.

For some time, such a study has been in progress at the University of Illinois College of Medicine, Department of Otolaryngology. All tissues removed from the sinuses for biopsy at the Research and Educational Hospital during the past ten years were examined and the investigation included also a careful perusal of the dispensary and hospital records of the cases in which an operation had been done. In many of the cases the tissues removed were simple polyps and were excluded from this report; in others, specimens had been so trauma-

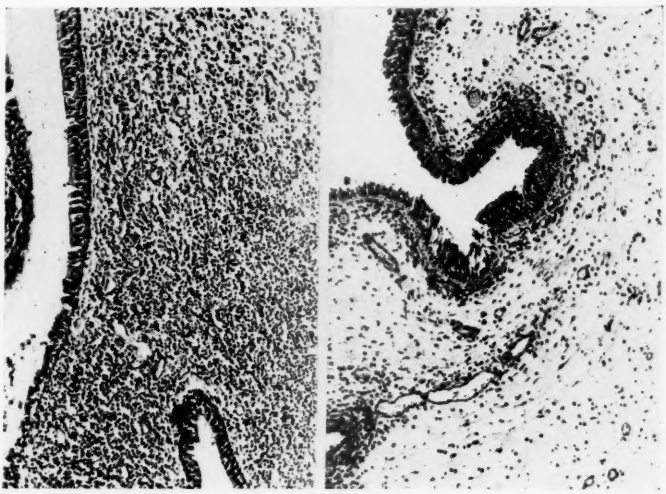

Fig. 1. Case 1.—Photomicrograph of ethmoid mucosa showing chronic simple inflammation with moderate eosinophilia.

Fig. 2. Case 2.—Photomicrograph of ethmoid mucosa showing chronic simple inflammation with moderate eosinophilia.

tized on removal, that a proper interpretation of their histopathology was impossible.

In all, 82 cases were collected in which the slides and records were adequate for a proper analysis and classification.

The clinical records of these patients including the report of the findings on examination, roentgen study and the results of preoperative management reveal them to be of the type commonly recognized as proper subjects for radical procedures. It naturally follows that the sections studied in this series resemble those in any other large group of cases.

The majority of slides showed evidence of allergic manifestation by the presence of eosinophiles in large numbers. Other sections showed chronic simple and suppurative processes, and in several instances a combination of chronic inflammation and eosinophilia was present.

REPORT OF CASES

The following case reports were selected from the group of 82. They typify the average in findings, treatment and results.

CASE 1. (Fig. 1) R. H., female, aged 22, was referred from the allergy clinic July 9, 1939, with the complaint of perennial asthma of five years' duration and a history of polypectomy seven years previously. Examination showed both nasal cavities to be filled with polyps.

On July 9, 1936 a bilateral external ethmo-sphenoidectomy was performed.

The pathologic diagnosis was chronic inflammation with moderate eosinophilia.

The patient felt fine for seven months following the operation, then asthma returned. She had daily attacks at first, then severe asthma.

Comment: The extensive radical procedure produced temporary relief only. The patient was then worse than she had been previous to the operation.

CASE 2. (Fig. 2) J. R., male aged 46, was seen February 3, 1934, complaining of nasal blockage. Examination showed polyps in both nasal cavities with a marked septal deviation to the left.

A bilateral ethmoidectomy and polypectomy was done the following week.

The pathologic diagnosis was simple chronic inflammation with moderate eosinophilia.

Comment: No attempt was made to bring about improvement with less radical measures such as septal resection and control of allergy. Subsequent history of this case was not obtainable.

CASE 3. (Fig. 3) Female, aged 60, was seen March 1, 1941, with the complaint of purulent nasal and postnasal discharge of three years' duration. Examination revealed pus in the right middle meatus, and by roentgen examination the right antrum showed involvement.

A Caldwell-Luc operation on the right side was performed.

The pathologic diagnosis was marked eosinophilia.

Comment: Nothing was done about her allergy preceding operation, and no improvement was obtained by the radical procedure.

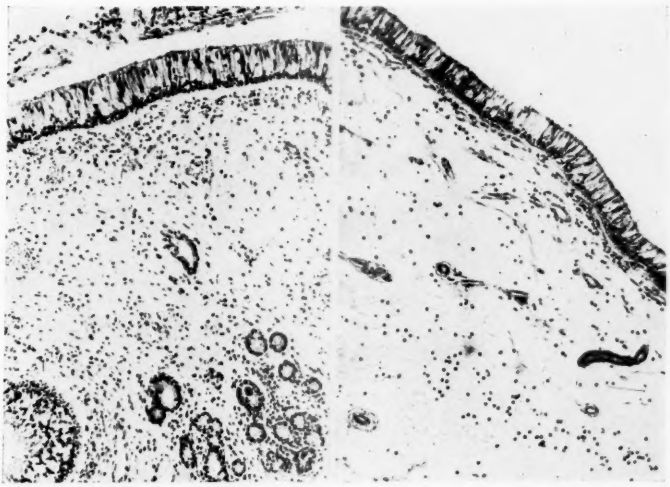

Fig. 3. Case 3.—Photomicrograph of antral mucosa showing edematous mucosa with eosinophilia.

Fig. 4. Case 4.—Photomicrograph of ethmoid mucosa showing edematous mucosa with eosinophilia. Note the excessive goblet cell formation.

CASE 4. (Fig. 4) A. S., female, aged 50, was seen May 24, 1935, complaining of continuous colds resembling hay fever of five years' duration with headache and nasal discharge which has been getting progressively worse.

Skin tests were reported to be negative. Examination showed a large polyp in the left middle meatus. No pus was present.

A bilateral external radical pansinus operation was performed.

The pathologic diagnosis was marked eosinophilia.

Two months after the operation a large amount of pus was observed in each naris. Two and one-half years later she developed a bilateral suppurative sinusitis. This was still present three months later.

Comment: Following surgery, purulent sinusitis developed, a condition which she did not have previously.

CASE 5. (Fig. 5) L. M., male, aged 43, was first seen on December 30, 1936, with headache and pain in the right eye and stuffy

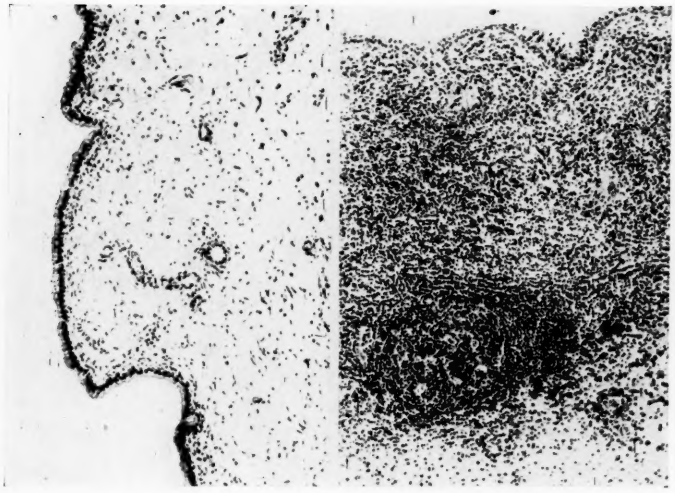

Fig. 5. Case 5.—Photomicrograph of antral mucosa showing chronic simple inflammation.

Fig. 6. Case 6.—Photomicrograph of antral mucosa showing chronic suppurative inflammation with lymph follicle.

nose of one week's duration. Antral irrigations were given at intervals with positive return from both sides.

On February 12, 1937, two and one-half months after onset, a bilateral Caldwell-Luc operation was done. Two months later, on April 24, 1937, a bilateral ethmoidectomy and polypectomy was done.

The pathologic diagnosis was simple chronic inflammation.

Eight months later the left window was closed and irrigation brought pus from both antra.

Comment: There was no improvement following antral operations and further surgery failed to help. In this type of case, adequate antral windows would probably have succeeded in the event that nonsurgical measures had failed.

CASE 6. (Fig. 6) S. G., male, aged 28, was seen June 5, 1936, complaining of intermittent dull pain over the right antrum with greenish nasal discharge of ten years' duration. He had had a nasal

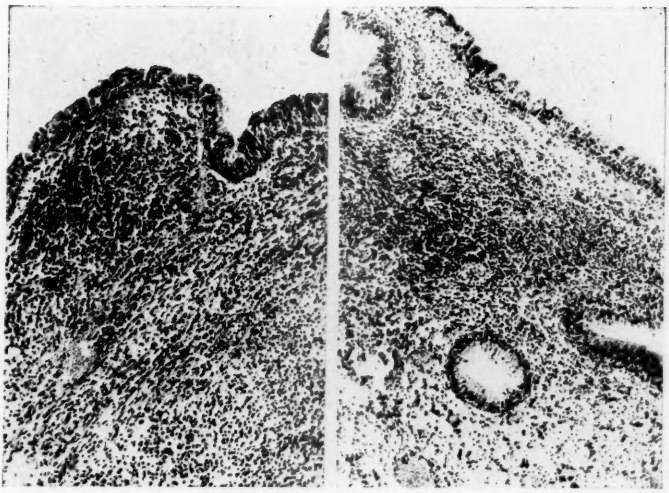

Fig. 7. Case 7.—Photomicrograph of frontal mucosa showing chronic suppurative inflammation.

Fig. 8. Case 8.—Photomicrograph of antral mucosa showing chronic suppurative inflammation.

operation 24 years previously and again two years later. Examination revealed pus in the right middle meatus and a deviated septum to the right blocking the middle meatus. The patient returned three years later, October 19, 1939, when irrigation of his right antrum produced greenish exudate. This procedure was repeated November 29, 1939, February 19, 1940, and March 6, 1941.

A Caldwell-Luc operation was done on March 24, 1941.

The pathologic diagnosis was chronic suppurative inflammation.

Irrigations on April 18 and May 16, 1941, showed the discharge to be still present.

Comment: The case continued as a suppurating maxillary sinusitis despite the radical procedure. Nothing was done about unblocking the middle meatus although the condition was noted at the time of the initial examination, nor could a few irrigations with months and even years between treatments be considered a fair test of the value of irrigation therapy in this type of case.

CASE 7. (Fig. 7) I. B., female, aged 64, was seen January 24, 1935. She had a chronic frontal sinusitis with external fistula of several years' duration.

On February 5, 1935, a radical Lynch procedure was done.

The pathologic diagnosis was chronic suppurative inflammation.

A draining fistulous tract was still present seven months after the operation.

Comment: There was failure to bring about a cure. In this case better results might have been obtained with conservative measures. In a large clinic this type of case is encountered regularly and healing is often attained with establishment of intranasal drainage. This must be accomplished in any event for a cure of the disease.

CASE 8. (Fig. 8) M. K., a student nurse, was seen July 3, 1939, complaining of pain over the left frontal and maxillary areas of two years' duration with anterior and postnasal yellowish discharge.

The roentgen diagnosis was chronic left pansinusitis.

On July 5, 1939, two polyps were removed from the left middle meatus and the left antrum was irrigated through the maxillary ostium with a return of greenish pus. Irrigation was repeated with similar results on July 11 and 13.

A Caldwell-Luc operation was performed on August 1, 1939.

The pathologic diagnosis was chronic suppurative inflammation.

Comment: The preoperative treatment was insufficient with nothing done to improve middle meatal drainage.

The results of the histopathologic study were as follows:

1. In the entire group studied there were no manifest degenerative tissue changes.

2. No signs of abscess formation were observed.

3. An intact epithelium was present in most cases. In tissues showing loss of epithelial cells ulcer formation might be suspected yet no underlying changes suggesting ulceration were discerned, so this loss must be attributed to injury received on removal.

Snitman[1] reporting the results of a similar study found no evidence of ulcer formation, although such findings have been reported by other investigators. This, he felt, was due to a misinterpretation

of the slides by these observers and he also felt that the loss of epithelium occasionally observed was caused by traumatization of tissues at the time of removal.

4. In the cases of simple chronic and suppurative inflammation the stroma showed active proliferation with tendency to heal. In the simple chronic types lymphocytes and plasma cells predominated. In the chronic suppurative types polymorphonuclear leucocytic infiltration was superimposed on a chronic proliferative process.

The microscopic study of a series of specimens of sinus mucosa leads to the realization that these membranes may be more properly designated as disease resisting, rather than diseased membranes. Regardless of the type or stage of chronicity it should be noted that the defensive process is fundamentally the same in all cases. The ciliated epithelium remains intact and under favorable conditions is capable of carrying on its function of removing the products of infection from the sinus. The defensive elements of the stroma are functioning in their fight against invading organisms as they have been since the onset of the infection and as they will continue to function indefinitely.

Cause of Chronicity. In an active suppurative case, purulent material is being constantly secreted into the sinus cavity and recovery from the infection depends to a great extent upon its prompt egress from the cavity.

Removal of exudate by irrigation provides only temporary relief as a rule, unless in the meantime drainage facilities improve to the point where they function constantly and adequately.

The sinus ostium, under ordinary conditions, aided by ciliary mechanism supplies an adequate drainage system but in certain cases defects are present which account for persistence of infection.

These defects may be anatomic or pathologic and often both types are present. In the anatomic, the most common barrier to drainage is the blocked middle meatus which may affect any or all of the sinuses in the anterior group. This condition is caused by an impinging middle turbinate, which may be wedged against the lateral nasal wall by septal deviations or spurs, or it may be due to a cellular turbinate or, as is often the case, the turbinate may hug the lateral wall for no apparent reason.

Next in importance are the encroaching ethmoid cells which affect primarily the drainage channels of the frontal sinus. These are

present as frontal cells in 25 per cent of cases and undoubtedly contribute in many instances to a prolongation of infection in the frontal sinus. Encroaching cells are also occasional factors in disturbance of sphenoid sinus drainage and drainage of the maxillary sinus in the form of an overhanging bulla but these are both comparatively rare in occurrence.

In the pathologic group the edema of allergy is the most prominent. Completely blocked cavities are not uncommon in allergic patients. The swelling involves the ostium and the tissues adjacent to the ostium and in many cases polyps are present, either within the cavity or obstructing the drainage space in the nose.

In the allergic cases a diminution of swelling occurs with elimination of the allergens to which the individual is sensitive. This is illustrated clearly in those who annually suffer from the blocked nasal cavities associated with hay fever and whose symptoms clear up promptly with disappearance of the ragweed pollen.

In the inflammatory cases the swelling is induced early by the acute reaction of the tissues to the pathogens. Later the swelling is maintained by the irritating effects of the stagnant exudate in which the mucosa is constantly bathed. In cases in which drainage is ample the exudate is carried off by the cilia as rapidly as it accumulates and the major factor in the production of mucosal swelling is thus eliminated. In the long-standing chronic cases there is a tendency toward permanent damage as the drainage channels become involved in the hyperplastic process.

Management of Chronic Sinus Disease. In the management of chronic sinus disease simple measures, if properly applied, suffice in a majority of cases. In the application of conservative methods attention is concentrated on the drainage area of the involved sinus and all efforts are directed toward a restoration of function of the ostium. Since the ostium's main function is to serve as a satisfactory drainage outlet, the problem is to see that this is accomplished by the simplest means possible.

In most cases of few months' or even a few years' duration the opening itself is not at fault, but rather the trouble lies in the relation of the adjacent tissues to the opening.

Considerable improvement in many cases follows a simple infraction of the middle turbinate or the removal of a few polyps. In others, however, correction of the drainage defects requires more ex-

tensive procedures such as septal resection, removal of obstructing cells, control of allergy, correction of other systemic disorders or treatment of an inflammatory condition in one of the other sinuses. The successful management of these cases often requires a painstaking study and careful planning and in some, a therapeutic regime covering a long period of time.

Progress of the case is noted by occasional roentgenologic studies with iodized oil in the sinus and by examination of the exudate removed by irrigation.

Each sinus requires special technics. Aside from the corrections listed above, periodic lavage is helpful in the removal of accumulated secretions and toward establishment of drainage. This is especially true as applied to the frontal sinus which responds unusually well to irrigation therapy. The cannula as it approaches the frontal ostium tends to break down the thin-walled cells which obstruct sinus drainage and improved drainage channels result.

The sphenoid also responds well to irrigation therapy. If it does not, thickened tissue may be present in the spheno-ethmoidal recess covering the opening. This is, as a rule, easily removed with biting forceps. In other cases a new opening may be placed in the anterior wall of the sinus below the ostium.

The ethmoid cells are treated by displacement therapy and will clear up satisfactorily, if in the meantime, barriers, anatomic and pathological, are properly taken care of. The cases which present the real problem in the ethmoid field are those which have been subjected to surgical procedures at one time or another, especially those in which portions of the middle turbinate have been removed.

Persistent infections in the maxillary sinus may often be traced to an unrecognized infection of ethmoidal or dental origin. In others, improvement is held up by an uncontrolled allergy with recurring polyps. Antrostomy is indicated in this type of case without disturbance of the sinus mucosa.

It is also indicated in cases of marked diminution in the size of the ostium. Various observers have noted a satisfactory response of the antral mucosa following intranasal antrostomy.

Tucker[2] reported the absence of polypi in nine such cases in which they had been observed at the time of operation.

Goodyear[3] noted the disappearance of hyperplasia in his "window" cases. This he felt was due to the fact that the mucosa was not

disturbed at the time of the operation; it was allowed to remain intact and recovered spontaneously. Goodyear adopted the intranasal procedure almost exclusively in those cases in which he formerly did a Caldwell-Luc operation. This change of technic was decided upon by the unsatisfactory results following extirpation of the lining membrane of the sinus. This membrane, he found, was often replaced by badly diseased fibrous tissue which in many cases required reoperation.

Hempstead[4] reported the success of the window operation in 97 per cent of 1,634 cases of his own and those collected from the literature. He noted a return to normal of the sinus mucosa which he felt was proof that drainage and ventilation of a sinus cavity permit a recovery of the tissues. Similar changes have been demonstrated by roentgen studies of patients treated by other means. The thickness of the lining membrane may be clearly outlined by films taken with iodized oil in the sinus. A disappearance of hyperplasia, as revealed by roentgenograms taken at intervals, is frequently observed in chronic sinus cases as the symptoms clear up.

These observations bear out the contention that most of the tissues removed at operation are not hopelessly diseased but, on the contrary, will demonstrate marked healing tendencies under favorable conditions.

The establishment of this fact alone is of signal importance to the progress of rhinology. The goal of the rhinologist is now clear. In the management of chronic sinus disease, he must supply the conditions which permit a recovery of the sinus mucosa and at the same time adopt all necessary measures to improve its defensive properties. He should keep in mind that those cases which appear to be hopeless often terminate satisfactorily and that the radical procedure offers no assurance of complete and permanent eradication of the disease.

SUMMARY

Successful therapeutic measures are those which spring from a sound knowledge of the anatomy, the physiology and the histopathology of the structures treated.

This was not realized by the earlier rhinologists who sacrificed functioning tissues indiscriminately in their misguided efforts to attain clinical results.

The methods adopted without a proper scientific foundation were largely unsuccessful and it is only within recent years that the reason for the previous failures has been ascertained.

All measures advocated now for treatment of nasal and sinus conditions must undergo careful scrutiny in the light of our better understanding of the function of nasal and sinus tissues.

Considerable attention is now directed toward an improvement in our methods of treating chronic sinus disease. The mucosa which lines the sinus cavities is now regarded as a membrane of defense with capabilities of carrying on indefinitely and of returning to a normal state under favorable conditions. The essentials for repair are provided by the institution of adequate sinus drainage and this is accomplished by the removal of drainage barriers from the neighborhood of the sinus ostium. These barriers may be anatomic or pathologic and are often corrected by simple measures.

In the event of failure to unblock the sinus outlets a new opening is often indicated and this should be accomplished without disturbing the functioning tissue.

Seldom is the radical removal of the sinus mucosa indicated and it should be instituted only with the understanding that such a procedure offers no assurance of complete and permanent termination of the disease.

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REFERENCES

1. Snitman, M. F.: Interpretation of Biopsies from Sinus Operations, Eye, Ear, Nose and Throat Monthly 22:377-379 (Oct.) 1943.

2. Tucker, J. C.: Conservative Surgical Treatment of Chronic Maxillary Sinusitis, ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY 37:631-633 (June) 1928.

3. Goodyear, H. M.: Chronic Antrum Infection, Arch. Otolaryng. 20:542-548 (Oct.) 1934.

4. Hempstead, B. E.: End Results of Intranasal Operation for Maxillary Sinusitis, Arch. Otolaryng. 30:711-715 (Nov.) 1939.

XL

THE ROLE OF THE OTOLOGIST IN A HEARING CONSERVATION PROGRAM

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A comprehensive hearing conservation program should affect all the people in any given area. It should affect the children as well as the adults, the adults as well as the children, the rich as well as the poor, the deaf, the hard of hearing, and even those who have no particular reason to suspect any hearing defect. Loss of hearing, as loss of vision or interference with any of the other body functions, is distinctly a medical problem. Therefore, the otologist should have and should assume the key role in any program to conserve the hearing of the nation. With this as a premise, let me be the first to admit that in the past the otologist has not met his obligations in this respect except in a desultory fashion. As an excuse for this apparent neglect in the past there were some extenuating circumstances. Until the last couple of decades there was not much that he could do for the person with a hearing defect. After he had made his examination and established the kind and the degree of hearing loss present, he either told the patient that there was nothing he could do to alleviate the condition or he tried a series of treatments with which he hoped to improve the condition, but which we now know were not particularly effective. As a consequence, the hard of hearing public became somewhat suspicious of the otologist, and from its standpoint, rightly so. As a result the otologist lost a position of control in regard to this particular defect, the hard of hearing patient was apt to regard him with suspicion and he himself lost interest in a condition which he thought he did not have much chance of improving.

All this has changed. With the perfection of better instruments for the detection and the measurement of hearing defects, such as the multiple phonograph audiometer and the pure tone audiometer, he is now in a position to make much more accurate diagnoses of the kind of hearing loss, to measure its degree and to watch its course. With the development of irradiation and its application to the treatment of

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adenoid vegetations in the nasopharynx, in Rosemüller's fossa and in the mouth of the eustachian tube, he is in a position actually to treat and improve the hearing defects of young children which are due to lymphoid hypertrophy, to nasopharyngeal infection and to otitis media.

With the development and gradual perfection of the hearing aid and the perfection of the lip-reading technic or visual hearing, he has adjuncts at hand which are very important in the rehabilitation of the deaf and the hard of hearing. And with the fenestration operation, more recently developed, he has an actual surgical means of improving the hearing in a few selected cases of conductive deafness which go under the general generic term of otosclerosis.

The otologist of today realizes that most of the hearing defects of adults are irreversible in character. They may be conductive in type due to chronic adhesive processes or to the hereditary condition known as otosclerosis They may be perceptive in type due to a great variety of causes, among which may be mentioned syphilis, tuberculosis, endocrine and metabolic disturbances, exposure to excessive noise or to blast concussions, skull fracture, focal infections, malaria and more particularly, its treatment with quinine, Ménière disturbances, brain concussions, excessive use of salicylic acid, salol and its derivatives, involvement from the toxins of such exanthema as mumps, scarlet fever, and measles, and lastly the gradual deterioration and degeneration of old age. But these fixed hearing changes are not amenable to medical or surgical treatment, with the exception of those few which can be benefited by the fenestration operation. For the remainder, the otologist must call in the help of lip-reading and the hearing aid.

The otologist himself cannot teach lip-reading. That is a science in itself and belongs to specially trained teachers. But what he can do is to mobilize all the lip-reading facilities in his particular area so that he can intelligently direct his patient to the proper teacher. We have in Wisconsin very excellent facilities for teaching lip-reading in the Speech Departments of the University of Wisconsin, Marquette University and in the various State Teachers' Colleges. In fact, Warren Gardner, the former president of the American Society of the Hard of Hearing and the present director of the Conservation of Hearing Program for the State of California, once said to me that if he wanted a good lip-reading teacher, he had to come as far east as Wisconsin. And it is remarkable with what little expenditure of time the average individual can learn to read lips, that is, unless he was either born deaf or acquired his deafness before he learned speech.

You have recently seen this demonstrated in our exhibits at the meetings of the American Medical Association and the American Academy of Ophthalmology and Otolaryngology.

In regard to hearing aids, there are several important facts that the otologist must keep in mind. In the first place, technically speaking, the modern radio tube hearing aid has made enormous strides since the day of the carbon aid. In the second place, not all the hearing aids on the market are adequate and equally efficient. The Council on Physical Medicine of the American Medical Association has set up certain minimum requirements which the hearing aid manufacturer must meet in order to have his instrument accepted by the A. M. A. To assist it in this work the Council has set up a Committee of Consultants consisting of otologists and sound physicists. The instrument presented for approval is carefully examined by this Committee as to workmanship and performance and if it meets the minimum requirements of the Council, the Council is advised to put its seal of acceptance on that particular model. This does not necessarily mean that every model of any one manufacturer has been so accepted. The otologist should acquaint himself with those instruments which have been accepted and can obtain a list of them by applying to the Council.

A third consideration is that, other things being equal, better performance can be expected from an air conduction than from a bone conduction instrument even in those cases in which bone conduction is particularly good. It takes many times the electrical energy to make an individual hear by bone conduction than by air conduction. Of course, it is understandable that an air conduction apparatus should not be fitted to one who has a discharging ear or to one with an irritative eczema of the external canal.

In the fourth place, each prospective buyer of a hearing aid should have his own individualized ear mold before he tries any air conduction instrument. There are too many chances for feed back squeals and other extraneous noises if a standard earpiece is used.

Even though a number of accepted instruments are available, this does not mean that they will all perform equally well in any given case. The fitting must still be made by trial and error. A hearing aid cannot be fitted to an audiometric curve. It must be fitted to the individual patient. I do not mean to imply that the otologist should personally fit hearing aids. This is a highly specialized job. But I do believe that he should supervise the fitting of an instrument and be able to check in some way its performance. At present this can only

be done in a rough fashion, but I do hope and I do believe that after the war we will have available some individual high fidelity phonographic apparatus which will release speech, music and other everyday sounds in graduated decibel steps. Such an instrument can then be used by each otologist to test the patient's capacity to hear and understand speech both before and after the use of a hearing aid. I say this advisedly, for every otologist knows that an audiometric examination with a pure tone audiometer does not measure an individual's capacity to hear and understand speech. I know that we would have such an apparatus available to each otologist at the present time if this war had not interfered.

While the individuals with a flat type hearing curve and the patients with a conductive type defect offer the most fertile field for improved hearing with a hearing aid, the same cannot be said for those with a high degree perceptive deafness. In these cases the available band between the point where high tones are heard and the point at which a pain sensation is produced is sometimes exceedingly narrow. Some hearing aid salesmen will glibly tell you that by some sort of selective attachment to their instruments they can equalize the hearing for all tones. In other words, that they can increase the hearing for the high tones and leave the hearing low for the low tones or vowel tones as it was. This is possible only to a very limited degree and most of these claims are exaggerations. Even if it were true and they could make the hearing for high tones commensurate with that of the low tones, they would encroach upon the level of pain perception of those individuals in whom the hearing for high tones is greatly depressed, with the result that even if the patient could hear the high tones better, he could not tolerate such hearing because of the pain produced. And so the individual with a high perceptive type loss must be content with a little boost from his hearing aid and he must piece out the consonant pattern of speech by lip-reading, for it is just the consonant sounds of the language which he will not hear well with his hearing aid alone. And we otologists must bear this in mind and not content ourselves with ordering a hearing aid for these individuals without at the same time insisting on the study of lip reading. In fact, I believe it would be better to advise a course in lip-reading before such an individual purchases a hearing aid.

A few words to debunk the popular lay conception that the fenestration operation is a cure-all for deafness. In the first place, the fenestration operation is only applicable to the relatively few cases of conductive deafness known under the much abused term of otosclerosis. It is of no use whatsoever to improve perceptive or inner

ear deafness. Secondly, it is an extremely difficult and time-consuming operation, in which an artificial opening is made through the bone of the relatively small semicircular canal or in the surgical dome of the vestibule. This is done under intense illumination and with strong magnification by the use of small burrs. The close proximity of the facial nerve to the operative field makes its injury more than a theoretical possibility. The small window or fenestrum which is designed to short-circuit the sound waves around the fixed and closed oval window is covered over with a flap made from the membrana tympani and the adjacent membranous posterior canal wall. The greatest difficulty in the operative result is in maintaining the patency of the artificially created fenestrum.

Initially there is a great improvement in hearing in the properly selected case. If the fenestrum in the bone is maintained, this improvement may be more or less permanent. However, in many cases the fenestrum tends to close due to the inherent characteristic of bone to repair any injury to it. This results in many cases in a gradual drop in the operatively improved hearing to its pre-operative level or even lower. It must, however, be conceded that in many cases the operative improvement has been maintained for as long as four or five years. It is just in the conductive type of hearing defect that the hearing aid gives its greatest hearing boost. It is also in this type of hearing defect that the operation offers its greatest benefit. It is, therefore, problematical in my mind whether the otologist should advise the fenestration operation which may result in a facial paralysis, which may entail long periods of postoperative vertigo, and in which the permanence of the hearing gain cannot be predicted with any degree of certainty, when he has at his disposal a hearing aid which will, in just this condition, give maximum results. We certainly hope that this operation will be so perfected in the future that it will offer more certain chances of permanent improvement in the selected cases.

The otologist has not discharged his full obligation to the hard of hearing patient with an irreversible loss of hearing by making a diagnosis and then sending the patient off to take a course in lip-reading and to purchase a hearing aid. This patient needs a great deal of psychological and psychiatric preparation before these measures are carried out. The doctor must explain the limitation of the hearing aid. He must tell his patient what can be expected from lip-reading and a hearing aid and what cannot be expected. He must carefully and understandingly explain to the patient the difficulties he will have to face in adjusting himself to an aid. And he must be prepared to give of his time to lend psychological encouragement to

the patient during this difficult adjustment period. He should not be content to send his patient off to learn lip-reading and buy a hearing aid and then shut his door.

Whereas the majority of the hearing defects of adults are fixed in character, this is not true among children. And it is in this group that the otologist finds his greatest opportunity for real conservation of hearing. There are between four and five million children in our public schools with hearing defects of one degree and another. Some of these are minor in degree and can only be detected by a systematic and periodic search or survey but they constitute the initial phase of a greater defect later in life. These minor hearing losses are not of suffiicient degree to be detected casually and can only be unearthed by systematic and periodic audiometric examinations. In from 10 to 20 per cent of the public school children with hearing defects, the condition is fixed and irreversible as it is in the majority of the adult cases. In this small group the defect in hearing is caused by such things as congenital anomalies, meningitis, the toxemia of measles, scarlet fever, mumps and whooping cough, and by the chronic adhesive processes resulting from repeated and long continued attacks of otitis media. In this group of cases the problem of the otologist is the same as it is in the fixed hearing losses of adults. Even with these youngsters much can be accomplished through lip-reading and hearing aids so that they can continue their education in the public schools and so that they need not be segregated in special schools for the handicapped. Such segregation is apt to have a marked psychic effect upon the child and result in an inferiority complex. Furthermore these youngsters should be carefully watched so that eustachian blockage, nose, throat and ear infections do not add to their already present and irreversible hearing defects. And for those youngsters whose hearing loss is so marked that they cannot be helped sufficiently to continue their education in the public schools, we have in Wisconsin a State School for the Deaf and 25 excellent day schools for the deaf and the hard of hearing child. In addition to this roving teachers of lip-reading are attached to the Milwaukee public schools as they are in some of our other larger cities.

In the other large group of children with hearing defects, estimated at from 80 to 90 per cent, the hearing loss is caused by interference with the proper action of the eustachian tubes. This may result from the pressure of enlarged tonsils and adenoids, especially the adenoids, from lymphoid tissue within the mouth of the tube, from chronic or recurrent infection in the nasopharynx, from repeated colds and from repeated attacks of otitis media. In these cases the

otologist can exert a very positive medical and surgical influence in the conservation of the hearing function. The enlarged and infected tonsils and adenoids must be removed thoroughly, and I stress the word "thoroughly." Too often do I see cases in which the tonsils have been efficiently removed but large masses of adenoids remain. This is partly true because the tonsil and adenoid operation has to a considerable extent fallen into the hands of the general practitioner who is inadequately trained to remove a tissue which he cannot see. But even the trained otologist needs to exert greater care in completely removing adenoid vegetation from the nasopharynx. Too often, I believe, we hide behind the statement that the adenoids "have recurred."

The adenoid operation is probably the most poorly performed operation in present-day surgery. This is due to a number of factors. First, lack of knowledge about the form and contour of the nasopharynx, the position of the adenoid growth, the depth of Rosenmüller's fossa and the position and form of the eustachian torus. Second, the adenoid operation cannot be properly performed with insufficient anesthesia. Too often the anesthetist is allowing the child to "come out" when the operator has finished his tonsil removal and is getting ready to work on the adenoids. Personally, I believe it is wiser to do the adenoid operation first and the tonsil removal last. The third factor is improper position of the head. Unless the operator is very insistent about it, the anesthetist will invariably extend the head during the operation. This position of the head throws the body of the atlas forward and creates above it a deep cul de sac from which no instrument can remove the lymphoid tissue. The fourth cause for a poor adenoid operation is inadequate or no inspection of the nasopharynx after the operation. It is so easy to elevate the soft palate with something like a Love palate retractor or insert a Yankauer speculum and then remove adenoid rests or islands, that one wonders why it is not more often done.

In those children who have a hearing defect that does not clear up promptly after an efficient, indicated tonsil and and adenoid operation, we can suspect the presence of lymphoid tissue within the tube and in these cases we should irradiate the nasopharynx with radium applicators after the method of Crowe. If the radium applicators are not available, deep x-ray radiation can be substituted.

The etiology of frequent colds should be investigated. The general health of the child should be improved by proper diet, sunshine, vitamin therapy and so forth, to eliminate the tendency to frequent colds. Running ears should not be left to take care of themselevs.

By proper cleansing treatments, by the general or local use of such drugs as penicillin, gramicidin, tyrothricin and the sulfonamide compounds, and by a regime to increase the general resistance of the child, the attack of otitis media can be cut short before it has resulted in any permanent damage to the hearing function.

I hope that I have demonstrated that the otologist has a very solemn obligation to, and a very important place in, a hearing conservation program.

324 East Wisconsin Avenue.

XLI

CHRONIC DEAFNESS
ITS TREATMENT IN THE ARMY

MAJOR EDWARD H. TRUEX, JR., M.C.

BUTLER, PA.

Deafness and defective hearing have always been one of the irritating thorns in the halo of medical practice. We, as otolaryngologists, have had no effective therapeutic methods with which to cure these conditions, and we have had neither the apparatus nor the time to embark on extensive programs of substitution therapy. Both the doctor and the handicapped individual had come to regard deafness with a sensation of utter frustration. Many doctors have never demonstrated sincere interest in this physical deficiency and as a result the patient has been allowed to drift aimlessly, desperately seeking help from anyone who could offer the slightest encouragement. He is regarded as eccentric and boring, sometimes mentally deficient, and usually psychologically maladjusted. Even the doctor is frequently convinced of these traits and prefers other types of cases in his daily practice.

During the past decade with the development of the portable vacuum tube hearing aid, and more recently, of a promising surgical procedure for certain cases of hypacusis, a wave of enthusiasm has swept the profession. It is our hope that the work being done by the army will assist in perpetuating this new medical interest in the problems of the deaf man.

Recent estimates from the Office of the Surgeon General[1] reveal that about 40,000 men with impaired hearing were inducted into the armed forces. Rowntree, et al[2] reported four men with defective hearing out of every 1,000 18- and 19-year-old registrants examined, but only one out of every 1,000 was rejected because of hearing deficiency. These rejections account only for cases of defective hearing that were discovered. I do not consider the whispered or spoken voice tests as carried out in most induction stations to be of sufficient qualitative or quantitative value to do more than screen out most of

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the severe hearing impairments. This statement is based on personal experience in one induction center, on reliable reports of medical men who have worked in other state induction centers, on the memories of many hundreds of patients who describe the hearing tests they received, and on a study of cases at Deshon General Hospital. This study showed that approximately 50 per cent of the patients admitted to Deshon General Hospital because of deficient hearing gave definite histories of that deficiency before induction. Yet, more than one-half of these men were recorded as having normal hearing on the induction physical examination. Suffice it to say that the greatest mobilization of man power in the history of this country was effectively accomplished to meet the emergency that had descended so rapidly upon us. Now that the crisis has been passed reparations are in full swing.

It is difficult to estimate the number of hearing impairments that will be attributed to military service during this war. As of May 1, 1945, more than 4,200 men had been treated in the three army hospitals specializing in this work. We are prepared to admit between 10,000 and 14,000[3] during 1945. To clarify the significance of these figures it must be emphasized that only those men whose loss amounts to 30 decibels or more in the better ear in the pure tone speech range (256-2048 d.v.) and whose loss is chronic or progressive in character are sent to us for admission. It is evident that large numbers of patients with lesser degrees of impairment or even total deafness in one ear are not candidates for rehabilitation, yet will swell the hearing disability statistics many fold in the final analysis some years after demobilization.

The three centers are strategically located at Deshon General Hospital in Butler, Pennsylvania, Borden General Hospital in Chickasha, Oklahoma, and Hoff General Hospital in Santa Barbara, California. The purpose of these centers is to restore each hard of hearing soldier to the army or to civilian life with a maximum of speech perception and a minimum of the handicaps that frequently result from this sensory deficiency. With this purpose in mind it is easy to visualize the scope of the activities that had to be encompassed. It involves the medical, the physical, and the social sciences. In a sense the entire project was creative in that no similar centers approaching these in size or scope had ever been organized heretofore. During the last 25 years the practice of medicine has become a science of specialties and is seen to approach functional perfection in the various highly specialized army hospitals throughout this country. The Surgeon General of the Army has always encouraged research and

development, a factor which has been of immeasurable importance in making possible many of the contributions to medical science that will emerge from this war.

Less than two years ago there were no army installations prepared to care for deaf soldiers. No apparatus was on hand, and as a matter of fact, some of the necessary apparatus had not even been thoroughly conceived. Today, however, each of the three centers has been furnished with sufficient equipment and has been assigned specialized personnel:

1. To make a diagnosis of all existing maladies;

2. To carry out local and general therapeutic measures designed to improve or cure abnormalities that are discovered;

3. To give intensive instruction in the art of reading lips;

4. To supply each individual with the best available hearing aid for his particular loss, provided sufficient measurable benefit warrants the use of such an instrument;

5. To teach each patient to whom an aid is given how to use that aid in conjunction with his residual hearing and his ability to read lips;

6. To prevent and correct deteriorations of speech which may quickly jeopardize satisfactory social and economic adjustment;

7. To assist the patient in avoiding the pitfalls of seclusion and introversion, and emotional aberrations;

8. To assist those who are unfit for further military service in continuing rehabilitation measures through civilian agencies.

9. To carry out a vocational testing and guidance program for those men who are being discharged from the army.

The effectiveness of these activities depends upon their integration, one with the other, into a system of therapy which is adequately standardized to apply to the mass of patients as a whole, yet sufficiently flexible to permit attention to the individual problems that are encountered by each patient. This is the "art of medicine" that can not be ignored in any system of socialized medicine if maximum benefit to the patient is the primary aim. Therein lies much of the success that is evident in the army's treatment of the hard of hearing soldier.

The remainder of this presentation pertains to Deshon General Hospital.

Figure 1 demonstrates the functional organization of the staff and the distribution of personnel within that organization. The four technicians in the ear mold laboratory are under the direct supervision of the Dental Service and the three men in physical and educational reconditioning are supervised by the Reconditioning Service. All, however, are assigned full time to Aural Rehabilitation and their activities are part of the program.

The period of hospitalization for each patient is divided into two phases: first, the short processing period lasting about three days during which time all the necessary initial examinations are made and his program of therapy decided upon and, second, the treatment phase which averages two and one-half months.

Immediately after being admitted to a ward, the patient is given a routing slip which initiates him into Phase I. The routing slip consists of a few simple directions and a list of persons that he must see. Heading this list is a young lady who has made a very excellent adjustment to a severe hearing loss through the use of a hearing aid and lip-reading ability. She records certain specific information about the patient for circulation throughout the clinic and gives him a general description of the program that is in store for him. Needless to say, this first contact has proven extremely important in elevating the morale of the patient who is bewildered and discouraged by his handicap. The record thus begun is forwarded to the Red Cross where the patient is next interviewed. The Red Cross was placed second on the routing slip because the man returning from overseas is usually in immediate need of the service that it renders in settling a variety of personal problems, usually pertaining to his family and his financial situation He is enlightened on and invited to participate in the recreational and entertainment programs that are maintained at the post. The Red Cross is indispensable.

Following this interview he undergoes a complete general medical examination and a careful otological study. Consultations are instituted for any abnormal findings and specific treatment is begun if deemed necessary. The records are then transferred to the acoustic section where the patient receives his initial hearing tests. Then, if it has been determined that treatment is not going to restore normal hearing and that the degree of hearing loss warrants an aid, the program for selection and fitting is begun. The processing period is continued in the Auricular Training Department. In this department the circumstances under which his hearing loss has been most handicapping are recorded. He is given sound and speech discrimination tests without amplification and then with a group type hear-

ORGANIZATION OF AURAL REHABILITATION DESHON GENERAL HOSPITAL

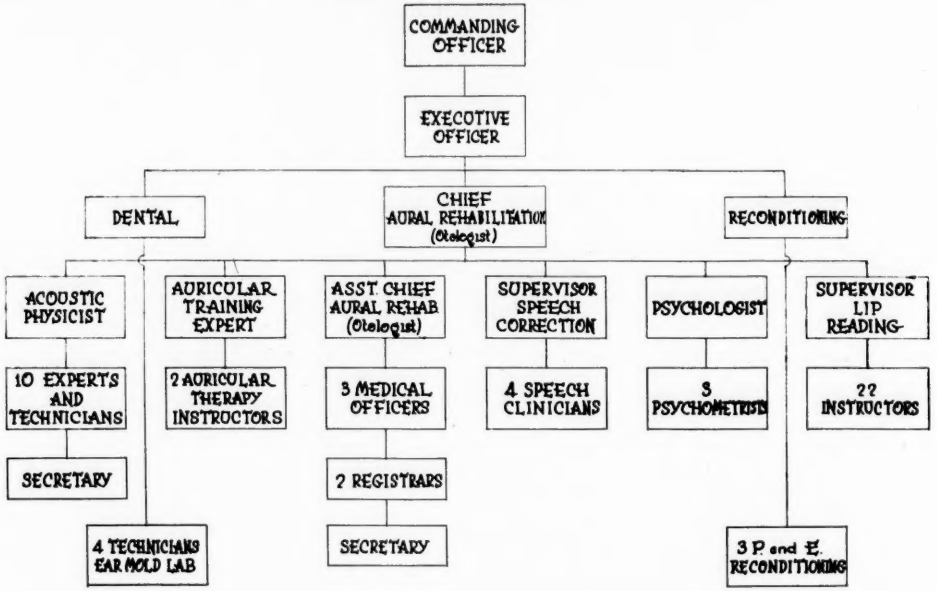

Fig. 1.

ing aid. It is thereby determined what phases of training must be emphasized during his hospitalization, careful consideration being given to his civilian occupation and the conditions under which he will work. By means of the group hearing aid the patient is given an introduction to his new sound environment and at the same time the instructors estimate the benefits and problems he will experience in using an aid.

An interview with the principal of the school of lip-reading follows, and a correctionist analyzes his speech. Each describes her particular part in the program and schedules him for classes that are needed.

The psychologist is last on the routing slip. By this time the patient has come to feel at ease and is usually ready to give vent to his emotions and his imagination. He is invited—not ordered—to take psychometric tests. Once started he almost invariably returns for additional tests among which are the Rorschach, the Wechsler Intelligence, the Strong Vocational Interest, the Kuder Preference, and the Murray TAT. A great deal of information is thereby obtained, but I must say that the psychology of deafness is not a measurable entity and that it is extremely difficult in most cases to isolate the psychological manifestations of deafness from those of military service, combat and battle injury. All are psychically traumatizing.

During this processing period, routine laboratory examinations are done; maximum correction of vision is obtained; and necessary dental treatment is instituted. The accumulated records are then reviewed, and tentative diagnoses are inserted. At this time the patient who has just returned from overseas is given a furlough. Some who are severely handicapped prefer to defer their furloughs until after restoration of conversational hearing. Most, however, go home happily, aware of the fact that the army has made just as careful provision for their treatment as it did for the man with shrapnel wounds. Needless to say, many have had shrapnel wounds as well as the hearing impairment.

Phase II begins when he returns from his furlough. He is placed in one of ten patient-sections with 30 or 40 other men and embarks on a rigid schedule of treatment, testing and training. Medical and surgical treatment is carried out when indicated. However, the fenestration operation is not being performed in the army, and there is no indication that it will be accepted by the Surgeon General as a standard therapeutic procedure in the near future. A few very carefully selected patients have been discharged from the army after

preparations had been made for the operation in civilian life. In addition to medical therapy the daily curriculum for the average patient is essentially as follows:

1. He attends one 40-minute individual class in lip-reading. If he is intellectually and emotionally suited, he is soon matched with other students and continues his course in a small group class.

2. He attends one or more 40-minute group practice classes with all of the other men in his section in order to practice his lip-reading with everyday conversational material Once each week special instruction is given during this session using moving pictures as a pedagogical medium. These scenes were designed to train the student to take advantage of every visual clue that accompanies normal conversation.

3. Certain hours are set aside for the hearing aid fitting and selection process and for auricular training. In this latter work he receives special instruction and practical experience in the use of an instrument; for example, he learns how to telephone, and under supervision is exposed to male and female speech, singing voices, orchestral music, and everyday noises. He is given drill in word discrimination and sound localization.

4. Another 40-minute period is devoted to correction of existing speech abnormalities or instruction in the prevention of speech deteriorations. The playing back of the patient's recorded speech and the development of a kinesthetic appreciation of voice quality are basic in this work.

These activities consume one half of his day, either morning or afternoon. The other half is devoted to "reconditioning," and again he adheres to a rigid time schedule. Supervised exercises, competitive sports, special educational classes, military lectures and films and voluntary recreation fill the remainder of his day. In addition, however, he is required to maintain the condition of his wards for inspection according to military standards and to carry out certain work details as part of post maintenance. Once each week he is obliged to attend a lecture which over the course of eight weeks covers the following subjects:

1. Medical Treatment of Deafness.
2. The Hearing Aid—Its Limitations.
3 The Veterans' Administration.
4. The G. I. Bill of Rights.

5. The Local Red Cross Organizations.
6. The Societies for Hard of Hearing.
7. Your Place in Employment and Society.
8. Tin Ear Joe in the Army.

The last lecture in this series is in reality an open airing for all "gripes" which are not uncommon, particularly among men who are returning to duty. Griping is not unhealthy. On the contrary, we consider it beneficial when carried out in groups with officers, and a modicum of profanity is an excellent medium for establishing the necessary rapport.

Once each week the patients are invited to take part in a "bull session" with the medical officers. There is no formality and the subjects for discussion arise out of questions asked. These usually concern the structure, the function, and the abnormalities of the ear. Favorite questions now, however, pertain to the fenestration operation and the "finger treatment" to the nasopharynx. It is difficult to talk about these subjects at a verbal level equal to that of the average patient, but it is a certainty that this type of discussion has a remarkable therapeutic effect.

From a psychotherapeutic point of view the entire program is designed to prove to the patient that defective hearing as a handicap can be overcome. The aid and lip-reading reestablishes his contact with the world of conversation and dispels the fear of isolation in a soundless environment. "But what can I do—this contraption, cords, these heavy batteries?" These are his thoughts, but self-pity is not tolerated by the other patients, and no coddling by staff members is permitted. The patient is shown that he can work, and he does work. He sees hundreds of other men in active play, so he plays. They sing, so he sings. They dance, so he dances. It is the psychology of the masses that is contagious, and it is the masses that return self-confidence to the individual.

Thus far, I have avoided the acoustic procedures of the program in order to present them concisely at this point.

We are convinced that the methods used at Deshon for selecting a hearing aid are the most advanced in this country. Our present system has evolved during the course of the past year and is too complicated for practical application in clinics of lesser magnitude, yet with continued study and simplification of apparatus, it is believed that a practical solution to hearing aid selection will emerge. There is no method, as yet, whereby a hearing aid can be prescribed as one

prescribes glasses. The analogy between glasses and the hearing aid is consistent only in so far as each is concerned with one of the special senses. Most eye glasses are prescribed to correct errors in refraction or accommodation. They are ground to mathematical precision, and their action is constant. The vision that is lost through injury to or disease of the retina cannot be restored by a lens nor can a hearing aid restore function to a degenerate aural end-organ. Most chronic hearing impairments give evidence of some abnormality in the neural elements of the auditory apparatus. The hearing aid is an instrument of variable precision. It supplements residual hearing by amplification. It does not correct hearing deficiency by replacing that which is lacking. Since it is our intention to give every man the best available hearing aid for his particular loss and since there is no formula whereby an instrument can be prescribed, it is necessary to run each patient through a thorough screening process with all instruments and a comparative evaluation program with the surviving few.

To thoroughly understand the acoustic procedures it must be remembered that the various steps outlined below cover a period of two to three weeks.

The first step consists of a determination of the character and the degree of hearing loss. A pure tone air conduction and bone conduction survey is made, followed immediately by a determination of the binaural loss for speech. Specially devised test material is used for this examination, the material being presented by live voice at a carefully monitored level through an amplifier and attenuator system to the patient's headphones. He sits in a soundproofed chamber and responds to the tests through a talk-back system. The intensity level at which the patient can repeat 50 per cent of the test items is his speech reception threshold. The difference in decibels between this level and the threshold similarly determined for normal listeners is the patient's "loss for speech." Incidentally, under these carefully controlled conditions the speech reception threshold can be repeated with greater clinical accuracy than the thresholds for pure tones. The staff at Deshon is convinced that the loss for speech should be determined with every audiometric test in order to make a comprehensive survey of the hearing handicap. This is evident from data obtained through the study of 611 routine cases wherein the mean loss for speech equaled the mean of average losses from 512 to 2048 d.v. on the audiometer. However, this study revealed *that in extreme cases the pure tone loss may be as much as* 40 *decibels less or* 30 *decibels greater than the loss for speech and that one-third of all cases showed a difference of* 11 *decibels or more between the two.*

We believe the loss for speech is a better indication of the handicapping effect of hearing impairment than the audiogram. An example is the case of a private whose pure tone hearing loss in each ear was recorded on several occasions between 50 and 60 decibels, yet, loss for speech was found to be between six and eight. This man has no practical need for a hearing aid nor did he express any desire for one.

This does not mean that the audiometer is unimportant in interpreting hearing acuity tests and fitting hearing aids. It reveals the pattern of loss and thus indicates the type of frequency response that should be favored in selecting the aid. It assists also in determining the selection between bone and air conduction receivers.

These tests are carried out between three and eight times for each patient during his stay in the hospital and at least twice before any hearing aid fitting process is begun.

The second step consists of determining which ear is to be fitted and making the individual lucite ear piece. Impressions are currently being made with a methylmethacrylate compound called Impression AC. This material is safer and more easily handled than plaster and since the casting is done immediately, shrinkage of the impression does not have to be considered. Frequently it is necessary to make ear pieces for both ears and give practical tests with instruments before choosing the ear for hearing aid use.

The third step is a group instructional interview wherein the patient is shown the process of selection and the part that he must play to insure optimum results. Preliminary screening of unsuitable instruments is then begun. From the data thus far obtained a trained technician chooses the transmitter, receiver and battery combinations from each make of hearing aid which theoretically compensates for the patient's hearing loss. All are tried and altered if necessary, using direct conversation with the patient as a medium for adjustments. This procedure for all practical purposes is identical with that used by salesmen in fitting a civilian, except that a variety of instruments is used and the merits of any of them are not discussed with the patient. For the civilian user this constitutes the entire selective process, whereas it is the most elementary step at Deshon. The patient's audiometric curves and the frequency response curves of each instrument are at hand during the fittings, but in spite of advertisements these data are of limited value in the fitting process. In the final analysis this procedure is a reversion to the patient's subjective evaluation of an instrument and is dependent, in part at least, on his memory of

normal hearing. Each fitting prescribed by this method, along with alternative fittings for every make, is carefully recorded and the record sent to the Hearing Aid Library.

The next step is the "trial use period." The patient borrows each of the seven to ten instruments that have been adjusted for him, one at a time, from the library. He keeps an instrument for at least 24 hours trying it under the varied conditions of his everyday activities in and about the hospital. At the end of the 24-hour trial period he is obliged to take that hearing aid to Listening Hour. This is a group class carried on with 25 to 30 patients at a time, during which a wide variety of everyday sound experiences is reproduced through a high quality loud speaker system or by live voice. The repertoire consists of such presentations as instrumental music, familiar and unfamiliar songs using both male and female voices, reading of prose with and without controlled background noise, and the sounds of a tractor, a planing mill, a buzz saw, ship's bells, and other sounds. The patient sits in the same seat for each Listening Hour presentation and passes judgment on the hearing aid that he is wearing. This judgment is based on the excellence of reception that it gives and is recorded for each sample presented during Listening Hour as: excellent, very good, good, fair or poor. Thse ratings have numerical values, and the samples are of weighted value according to their importance for the average listener. For example, a score of excellent (5 points) is doubled for reading in the presence of noise. The total of the numerical ratings is computed at the end of the hour and filed for comparison with every other instrument that the individual tries.

This step serves two distinct purposes. Firstly, it eliminates quickly and effectively the instruments that are definitely inferior. Secondly, it is the beginning of auricular training. The patient learns what to expect of a hearing aid. He learns its limitations. He develops skill in judging auditory situations and facility in manipulating the instruments. He learns to listen critically for differences in his sound environment.

The patient then enters the fifth phase of the selective process—the hearing aid evaluation tests.

The three instruments that rated highest in the Listening Hour are subjected to a series of performance tests using speech as the testing medium. The patient is closeted with these instruments in a soundproofed room barren of furnishings except for a chair, a high fidelity loud-speaker and a small microphone through which he can talk to the operator. The operator occupies a smaller soundproof

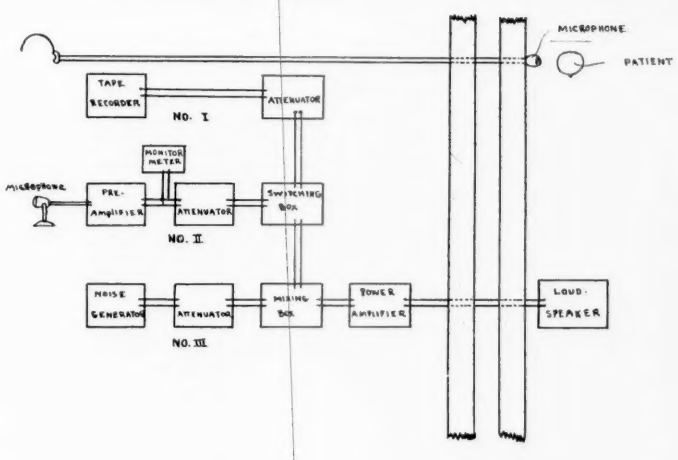

Fig. 2.—Diagram of apparatus for hearing aid evaluation.

room and has at his finger tips the controls of all the testing apparatus. Fig. 2 illustrates the apparatus and shows the three channels to the loud speaker in the patient's room. No. I is the channel for a magnetic tape recorder which repeats indefinitely any recorded speech. No II is for live voice, and No. III is for static noise. Each can be transmitted separately or mixed one with the other, and the intensity of each can be controlled by means of its respective attenuator. The evaluations are carried out as follows:

First the patient's binaural loss for speech is redetermined without a hearing aid, and he is given a 50-word articulation test. The test material is taken from one of a number of phonetically balanced lists and is scored as percentage of words correctly repeated.

The first hearing aid is then placed in a standard position on a baffle, eight feet in front of the loud speaker. Speech from the tape recorder is introduced through the system at 40 decibels of intensity, and the patient sets the volume control of the hearing aid to the point where reception is most comfortable. This setting is termed "the 40-decibel comfort level." Its purpose is to establish a base line for instrument comparison by eliminating, in so far as possible, the variations resulting from differences in the volume control element. Forty decibels was selected because it approximates the intensity level of low conversation. Occasionally 50 or even 60 decibels must be used for

the setting, but this is just as effective provided each instrument is set against the same intensity of speech.

With the volume setting thus established the speech reception threshold with the instrument is determined and when subtracted from the unaided threshold yields the instrument "gain." Tests are then made to determine the "tolerance limit" with the aid by increasing the intensity of speech to the point where the patient complains of annoyance, discomfort or pain, or to 95 decibels if he does not complain. The difference between the aided threshold and the tolerance limit establishes the range of hearing that the instrument affords, and it is an important consideration in view of the sudden extremes of sound intensity that occur in everyday situations.

The volume control of the hearing aid is next manipulated to "full," and these same tests are repeated. Then at a 50-decibel comfort setting of the instrument, speech is introduced and maintained at 50 decibels while noise is mixed into the system at increasing intensity. The level of noise at which the speech becomes unintelligible is recorded as the "resolving power" of the instrument. A recording of 0, for example, means that noise reached 50 decibels of intensity before speech was blotted out, —5 means that noise reached only 45 decibels, and +5 means that noise reached 55 decibels before speech became unintelligible.

Finally, the articulation test is repeated using a different list of words from that used initially. It is given at a level of intensity 25 decibels above the instrument threshold.

This entire series of tests is carried out with each of the hearing aids being evaluated. It furnishes the data whereby individual instruments can be compared one with the other.

The sixth and last step is the selection of that instrument which in the summation of accumulated data proves most beneficial for the individual patient. It is purchased for him at government expense but remains army property until he is discharged from the service.

The basic elements of this selective process have been in operation since June 1, 1944. Between that date and April 1, 1945, a total of 936 hearing aids were dispensed.

Analysis of records shows that these aids improve the average patient's hearing acuity to the point where he has only 13 to 18 decibels loss for speech. This puts him in the low normal range of hearing. The mean effective improvement is 35 decibels, which is grati-

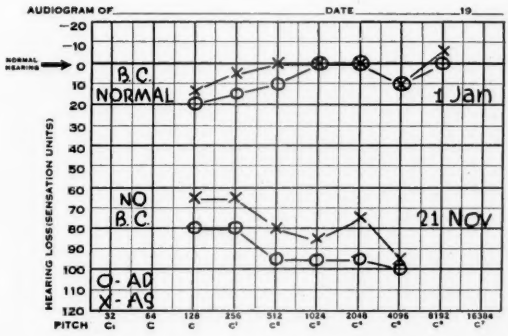

Fig. 3. Case 1.—A 21-year-old private who had taken part in campaigns in Africa, Sicily, Belgium, France and Germany, had frequently noticed temporary slight hearing impairment associated with a constant whistling tinnitus after exposure to artillery fire. On September 21, 1944, a shell explosion threw him to the roof of a low house. He regained consciousness six hours later without hearing. For several days thereafter some improvement was noted, but serviceable hearing did not return. He arrived at Deshon on November 20. There were no residual symptoms or signs referable to the nervous system. The right ear drum was perforated, the left was normal. Routine tuning fork tests were compatible with the audiometric findings. Approximately one week after admission he reported that his hearing seemed to be improving again and by January 1, about 70 days after the injury, complete recovery was recorded. His loss for speech on admission was 62 decibels but at the time of discharge it was recorded as 4 decibels.

fying in view of the 30 decibel gain suggested by Hughson[4] as acceptable hearing aid improvement.

To date, more than 2,000 patients have been admitted to the Deshon Center, and at the present time the daily census is about 425. The hearing impairment of these men was caused by otitis media in approximately 30 per cent of all cases, by acoustic trauma in 20 per cent, and by brain injuries and skull fractures in about three per cent. Systemic infections and extrinsic toxins caused five per cent of the cases, and another five per cent was attributed to a familial predisposition. For approximately one third of the cases of hearing loss, no definite causative agent could be found.

It is interesting that aviation has accounted for only about one per cent of our cases, which is contrary to expectations. Barotrauma apparently has not affected hearing as severely as was anticipated.

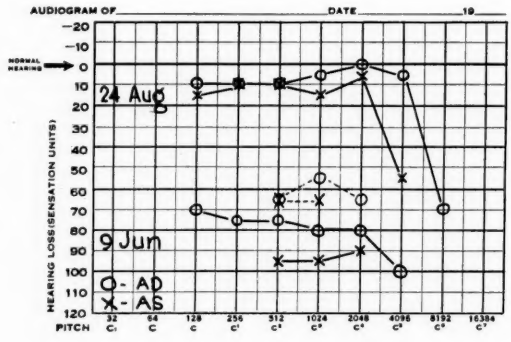

Fig. 4. Case 2.—A soldier was thrown to the ground and dazed by the explosion of a mortar shell at Bougainville, New Guinea, on March 11, 1944. For four hours thereafter he was totally deaf. After that period of time some improvement was noted, but there was no serviceable hearing. He was admitted to Deshon on June 5, 1944. There were no positive findings other than the hearing loss, but he stated that there had been a noticeable improvement during the two days prior to admission. He was sent home for 30 days and during that time a gradual restoration of hearing occurred. By July 10, there was an average loss of 28 and 37 decibels in the pure tone speech range in the right and the left ears respectively. He was maintained on the lip-reading schedule until August 24, when essentially normal hearing had become stabilized.

A finding of considerable interest is the clinical recovery of some cases of deafness resulting from blast injury. Human experimentation has demonstrated recovery from minor degrees of nerve deafness induced by noise. Clinical experience has shown that there are variations in the susceptibility of different individuals to deafness from acoustic trauma. Severe nerve deafness for all practical purposes is not a reversible phenomenon, but medical men returning from overseas assignments have cited many cases of "blast deafness" that recovered within eight weeks after the initial injury. In our own experience, during 1944, three men recovered out of 121 whose loss resulted from the concussive violence of high explosives or the muzzle blast of artillery (Figs. 3-5). There was no evidence of malingering or hysteria in any of these three men.

These cases are examples of a phenomenon which undoubtedly has occurred many times during this war. The pathology is not clear, and we cannot predict clinically which man will experience a restora-

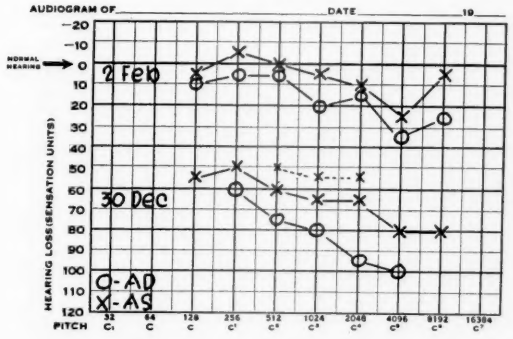

Fig. 5. Case 3.—A 36-year-old Sergeant sustained a very mild hearing impairment in 1928 as a result of anti-aircraft fire in the navy. He had signed a waiver for this defect when he enlisted in the army. He had noticed repeatedly that small arms fire during basic training made his hearing temporarily worse. On September 1, 1944, near Brest, France, six 88 mm. shells exploded near him. He received several minor flesh wounds and suffered a marked aggravation of his hearing loss.

At Deshon on December 30, 1944, he was found to have 88 and 60 decibels loss in the pure tone speech range and a 102 decibel loss for speech. Both ear drums were thickened and dull. No other positive otological findings were recorded.

Approximately two weeks after admission this patient reported a subjective improvement in hearing acuity and by February 2, five months after onset, he had essentially normal hearing. Only five decibels loss for speech was recorded.

tion of normal hearing. Hawkins, Lurie and Davis[5] subjected guinea pigs to traumatizing noises and studied the changes in the cochleas. The most severe lesions consisted of rupture of the organ of Corti. The minimum of pathology that could be detected consisted of "changes in the cytoplasm of the external hair cells" and disappearance of mesothelial cells beneath the basilar membrane. There was no indication in any of their histological studies that even these minimal lesions were reparable. To my knowledge, there is no accepted explanation, either physiological or pathological, for the injury and subsequent recovery process in some cases of traumatic nerve deafness.

In concluding this presentation, I would like to return to you a statement that originated here in Boston. Lurie[6] was referring to patients with nerve deafness when he said: "We as otologists have

nothing to offer them medically except from a psychological rehabilitational point of view."

The immediate future of deafness as a problem for solution lies in prevention, conservation of hearing and organized rehabilitational methods of treatment. The fenestration operation has a decidedly limited application at the present time. It is no panacea. In treating any organic injury, if no cure is possible, a maximum restoration of function should be sought by prosthetic appliances and by re-education if necessary. The practicing physician knows that there is no cure for chronic deafness. It is his responsibility at least to guide the victim away from charlatans into proper channels for treatment. Organizations such as the American Society for the Hard of Hearing, universities such as Northwestern, Iowa and Indiana, groups such as the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology and individuals such as the late Dr. Walter Hughson are paving the way for the future. The army's program for treating the chronically deaf or hard of hearing soldier is indirectly a result of their efforts, and it embodies a great many of the facts and philosophies engendered by them in its system of therapy. It is hoped that the work being done by the army will give added impetus to solving the problems of deafness in civilian life and will serve as one example for further efforts in this field.

DESHON GENERAL HOSPITAL.

REFERENCES

1. Otolaryngological Section, Office of the Surgeon General, Washington, D. C. By personal communication, April 17, 1945.

2. Rowntree, L. G., McGill, K. H., Edwards, T. I.: Causes of Rejection and Incidence of Defects Among 18 and 19-Year-Old Selective Service Registrants, J. A. M. A. 123:181 (Sept. 25) 1943.

3. Morrissett, L. E.: What the Army is Doing, Hearing News 13:2 (Feb.) 1945.

4. Hughson, Walter, and Thompson, Eva: The Hearing Aid from the Patient's Point of View, Arch. Otolaryng. 38:252 (Sept.) 1943.

5. Hawkins, J. E., Jr., Lurie, M. H., Davis, H.: Injury of the Inner Ear Produced by Exposure to Loud Tones, Laryngoscope 54:375 (Aug.) 1944.

6. Lurie, M. H.: Deafness, Its Causes and What Can Be Done About It, Tr. Am. Acad. Ophth. and Otolaryng. January-February, 1945, p. 173.

XLII

STROBOSCOPIC EXAMINATION OF THE EAR

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The otologist is handicapped in his understanding of the function of the peripheral ear by the failure to see the action of the conduction elements during their response to sound stimuli.

Movements of the conducting mechanism of the ear for threshold sounds are so minute as to preclude visualization. However, the ear has a great range of sensitivity and responds to stimuli millions of times as strong as those needed to produce a threshold response. Using over-threshold stimuli, many methods have been successfully employed in the laboratory to visualize the acoustic oscillation of the conduction apparatus. Common sources of sound have been the organ pipe and the voice. Using such stimuli led by tubing into the external canal of a fresh temporal bone, Politzer[1] for the first time in 1864 recorded on smoked paper the acoustic oscillation of a bristle stuck to the head of the malleus. Similarly Lucae[2] shortly afterwards recorded such movements to bone conducted sounds.

Light points from metallic powder dusted on these structures when set into acoustic oscillation spread out and form patterns (Lissajous Figures) that can be observed with the aid of a microscope. Such observations on the conducting elements of a fresh temporal bone were made by Politzer,[3] Buck,[4] Mach and Kessel[5] and others.

The wave form of a vibrating light point reflected from tiny mirrors stuck to various elements of the conduction apparatus can be recorded on photographic paper when the preparation is stimulated by sound waves. Such records have been successfully made by Dahmann,[6] Bekesy,[7] Frank,[8] aided by Broemser, Wada[9] and others. Wada stuck mirrors to various parts of the drum in living animals and noted differences in amplitude of oscillation to the same acoustic stimulus. Kohler[10] had a mirror stuck on the tympanic membrane and recorded

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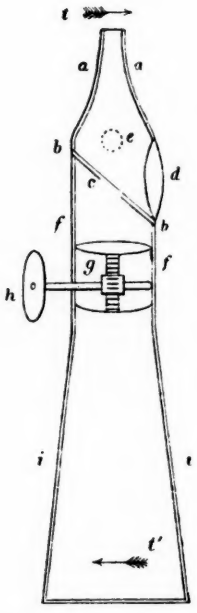

Fig. 1.—Speculum designed by Mach and Kessel in 1872 for stroboscopic examination of the acoustic movements of the drum.

photographically its oscillations with reflected light in response to the sounds of his voice and to bone conducted sounds.

The cavity of the outer ear closed by the drum has been used as a gas chamber connected to sound sensitive flames. Using intrinsic sounds and viewing the flame patterns in a rotating mirror, definite acoustic responses were observed by Berthhold.[11]

In 1874 Mach and Kessel[12] described a method for viewing the acoustic movements of the conducting system by stroboscopic light. They used suitably prepared fresh temporal bones stimulated through tubing by an organ pipe with a frequency near 256 cycles. They viewed the preparation by reflected sunlight (Heliostat) interrupted by means of the prongs of an electrically driven tuning fork. The ear structures were viewed through a microscope. Two years previously, they[13] described a method for stroboscopic observations on the human ear—using a specially constructed speculum (Fig. 1).

Interrupted sunlight from the heliostat entered a lens (d) in the side of this speculum. A perforated plain mirror (c) within the speculum reflected this light against the drum. This was reflected in turn from the drum through a lens onto a plain surface at the end of the speculum. This image was viewed with a microscope at a magnification of x 40. The 256 cycle organ pipe sound was led through tubing into a nipple opening (e) in the speculum. Mach and Kessel described in detail their observations on the ossicular chain and Kessel[14] his observations on the drum in fresh specimens. All the above experimental laboratory methods serve to point out that physiological acoustic stimuli can set up visible movements in the normal conducting elements of the human ear. The methods, however, do not lend themselves to clinical application. Years later Lucae[15] devised a method for the clinical examination of the ear under stroboscopic light. He used a mechanically interrupted light source similar to that used by Oertel[16] and by Spiess[17] in laryngeal stroboscopy. He reflected this light with a hand reflector into a Siegle speculum inserted into the subject's ear. Instead of a sound stimulus he used an electrically driven air pump[18] which delivered about 25 pulses per second carried through tubing to the speculum.

Indirect laboratory methods for examining the movements of the conducting elements of the living human ear have been described by Frenckner.[19] He used moving picture records of malleus movement in response to static pressure changes (not sound waves) to study the amount of excursion in the normal and in the otosclerotic ear. He also devised a method[20] for acoustically stimulating the malleus by an electrically driven probe and then measuring the amplitude of this movement. Previously Wilska[21] used a similar method in measuring the amplitude of excursion of the malleus for various frequencies at threshold. Lucae stimulated an ear simultaneously with a 128 and a 133 cycle organ pipe and noted oscillation of the drum at a frequency equal to the difference tone of 5 cycles per second.

In this laboratory, experimental observations similar to those of Mach and Kessel and including moving picture records were made by Kobrak[22, 23] on fresh temporal bones under stroboscopic illumination. The sound source was a dynamic loudspeaker unit driven by a vacuum tube oscillator and led to the external canal through tubing. The light was interrupted by a motor driven disc 120 times a second. A few living subjects were also examined with this experimental set-up.

The clinical application of this method of examining the function of the conduction elements was dependent on the use of a simple

Fig. 2.—Arrangement of equipment for examining the acoustic movements of the living ear under stroboscopic illumination. The light from the stroboscope is reflected from the head mirror through the Siegle speculum in the canal. At the same time sound generated by a loudspeaker driving unit is lead through tubing into the nipple on the side of the speculum.

sound source and a small stroboscopic light that could be reflected by the examiner's head mirror into the ear (Fig. 2). Such a stroboscope light source was already designed and in use in the clinic for examination of the vocal cords during phonation. It consisted of an 1800 cycle AC motor driving a disc, all mounted in a small box and fastened against the wall near the examining chair. An ordinary frosted light bulb with window, such as used for a light source in the clinic, was incorporated in the box. For laryngeal work a six-holed disc was used giving 180 interruptions per second. This disc was made easily demountable and for otologic examination was replaced by a two-holed disc. To solve the problem of a suitable sound source, experience with the design of a eustachean tube apparatus indicated the kind of sound source that promised to be satisfactory. The 60

cycle alternating current through a suitable transformer was made to activate the voice coil of a loud speaker driving unit, suitably mounted near the patient. The sound was collected by capping the opening in this unit and led through stethoscope tubing to the patient. The 60 cycle sound generated by this loud speaker driving unit was very loud when conducted directly into the canal. The tubing was attached to the nipple of a Siegle speculum and the ear was observed with a head mirror by the interrupted light of the stroboscope. To obtain a difference between the frequency of the light source and the sound, a rheostat in the stroboscope permitted a small change in the speed of the motor. A two-holed disc was substituted for the six-holed disc used for laryngeal work and interruptions of a few cycles per second above and below 60 could be produced. With this method, it was possible to make an examination of the patient's ear at the time that the rest of the clinical examination was carried out.

The size of the speculum used with the Siegle otoscope for this examination depended upon the size of the patient's external meatus. A close fit, but not necessarily an airtight one, between speculum and external canal was needed to confine the acoustic energy to the ear. In this manner, sound of sufficient intensity was delivered to the drum to produce movement that could be easily seen with the small magnification of the Siegle otoscope. The more firmly the speculum fit into the ear, the greater the oscillation. An oval-tipped speculum was particularly useful in obtaining an airtight closure of the canal. With a very loose fit or upon removing the speculum further from the meatus, no movements could be observed. The frequency of the observed oscillations was dependent on the difference in frequency of the light interruptions and the sound source. If there was no difference, no movement was observed. If the difference exceeded 10 or 15 cycles per second, the frequency of motion was too great to be followed by the eye and again no movement was visible. The rheostat on the stroboscope motor permitted control of the frequency of light interruption. The stroboscopic picture of an apparent rapid or slow motion of the drum could thus be obtained at will.

Experimental Observations with the Clinical Apparatus on the Fresh Human Temporal Bone. The elastic properties of the conducting system of the fresh specimen are similar to those of the living ear. The sound stimulus was adequate to move the drum as in the patient. Removal of the middle fossa plate exposed the entire ossicular chain to view with the head mirror. Acoustic movement of the chain was marked. As the head of the malleus moved in, the stapes could be seen to move out and vice versa, the ossicular chain rocking about a hori-

zontal axis from the fan-shaped ligament of the incus to the anterior ligament of the malleus. The preparation was further prepared by exposing the vestibular surface of the stapes footplate. Acoustic movement of the footplate was also noted. When the footplate was immobilized by light pressure with a cotton applicator, there was an immediate reduction of oscillation of the entire ossicular chain. The drum, however, continued to oscillate without apparant change in amplitude. Partial immobilization of the footplate also reduced the amplitude of oscillation of the rest of the chain. It is reasonable therefore to look for a reduction of malleus movement to sound in otosclerosis. While this is easily observed when looking down on the incudomalleal articulation it is much more difficult to see through the external canal.

The preparation can be further studied by exposing the anterior part of the middle ear to permit a view of the inner surface of the drum. The movement of the entire cone of drum is very clearly seen along with movement of the umbo. The anterior portion of the drum appears to move as much as the posterior part. The external examination of the ear, because of the position and the contour of the drum makes it difficult to see this movement at the umbo and the great movement of the anterior portion of the pars tensa.

Observations on the Normal Ear. The greatest amount of motion is observed in the drum. This is not uniform however. The posterior part of the drum appears to move much more than the anterior. Mach and Kessel computed the ratio to be about 4 to 1. The greatest excursion is seen half way between the umbo and the posterosuperior part of the annulus. The distance between the umbo and the annulus is greatest in this region. The least motion is seen in the handle of the malleus. This is not only quantitatively smaller but more difficult to observe because of the lack of good landmarks, such as light points on the drum. A posteromedial displacement of the whole malleus handle appears to take place. The short process is more easily observed for movement than the umbo. The movement is in the same phase, however, as the movement of the pars tensa. Shrapnell's membrane, where it is well defined, moves to a small degree and in the same phase as the pars tensa. Supplementary observations in the laboratory on the fresh temporal bone are similar and include the finding that as the malleus handle moves inward the head of the malleus moves outward The axis of rotation is near the neck of the malleus from the fan-shaped ligament of the incus to the anterior ligament of the malleus. When the sound was switched off all movement stopped, even though the ear was still being visualized by the strobo-

scopic illumination. Excursion of the drum to a 120 cycle sound produced by introducing a rectifier in the circuit could also be observed with a 60 cycle stroboscope.

DISCUSSION

The drum in response to an acoustic stimulus entering the canal does not appear to move with equal excursions but does appear to move in equal phase. The movement reproduces faithfully the impressed stimulus. Bekesy[7] has shown that only at very great intensity does the drum oscillation introduce harmonics of an impressed pure tone. The poor sensitivity of the ear to low frequency sounds, permits the use of an adequately strong stimulus just below the normal subject's threshold of tickling or pain. The use of the 60 cycle alternating current source for the sound stimulus greatly simplifies the equipment and permits the use of a small, constant and rugged unit, connected to the patient through stethoscope tubing. The output of a telephone earpiece so driven and similarly mounted is not adequate to produce oscillation of the drum that can be visualized with standard clinic tools, such as a Siegle speculum. With a driving unit of a loudspeaker, sufficient excursion of the drum can be produced to be easily visualized with the small magnification of a Siegle speculum. In this way it is possible to carry out a functional examination in each patient, and to demonstrate to the otologist and the student that movements of the conducting elements of the ear actually occur as the subject is hearing the sound. The output of sound in the driving unit is controlled by a variable resistance and can be reduced to near threshold. However, only a small range, near maximum output, is adequate to produce visible movements of the drum.

Observations in Perception Deafness. As was to be expected in perception deafness no impairment or distortion of the drum and malleus movement could be observed under stroboscopic illumination. As in the normal ear, movement of the malleus was definite though greatly less than the excursions of the drum itself, particularly the posterosuperior portion of the pars tensa. The intensity of the 60 cycle sound at maximum output of the driving unit is not far from the threshold of tickle or pain and an occasional normal and nerve-deaf patient described this sensation. Withdrawing the speculum, allowing some sound energy to escape, made the sound more comfortable and still permitted observation of the movement though at reduced amplitude.

Observations in Otosclerosis. The sound was easily tolerated by these subjects. Indeed it produced a pleasant sensation—the patient

often believing that he was receiving some sort of treatment in this manner. The stimulus was not unlike the stimulus produced by the pneumomassage apparatus that had been used by Lucae in the treatment of conduction-deaf patients.

The drum movement was similar to that seen in the normal ear. The movement of the malleus was often but not regularly thought to be diminished. However, the total normal movement produced in the malleus when viewed through the canal with a Siegle speculum is so small as to be difficult to assess. When there was an asymmetry in the audiogram of the two ears, a reduction in malleus movement in the deafer ear was more suggestive.

DISCUSSION

The conduction lesion permitted great stimulation without discomfort. In the normal ear the upper limit of tolerance to sound is marked by tickling or pain in the ear, which is supposedly due to stimulation of nerve end organs in the conduction elements. The unimpaired drum movements without pain or tickle in otosclerosis would point to the ossicular chain itself as the source of this sensation rather than the drum. The threshold of pain or tickling in conduction-deaf ears is definitely elevated above the normal or nerve deafened ear. In normal ears Frenckner observed two movements of the malleus to static pressure—one a mass parallel displacement of the handle, the other a rotation or hinge-like movement from the region of the short process. Only parallel displacement seemed to be arrested in several of his patients with otosclerosis. Such differences could not be seen with our equipment. The response to slow large pressure changes, such as Frenckner used, is not physiological in intensity or frequency. The slow and great change allows a greater differential motion between the malleus and the incus at the joint (a protective effect) but at acoustic frequencies this play is reduced, and the incus follows more faithfully the malleus in its movement. This would allow for a reaction to any arresting influence in the acoustic oscillation in any part of the ossicular chain and a greater effect on the excursion of the malleus.

Observations on Perforation of the Pars Tensa. Reduction or loss of visible movement of the drum was noted in the presence of a perforation—even when this perforation was small. The relatively small range of intensity in this equipment that was effective in producing visible drum movement in the normal ear, did not permit of a sufficiently strong stimulus to visibly move the perforated drum. The lack of visible movement with the otoscope represented impairment

of function through only a small percentage of the intensity range to which the ear can react. Where a perforation was closed by a thin atrophic scar, this area appeared under stroboscopic illumination to move slightly more than the adjacent normal pars tensa.

Observations on Perforation of Shrapnell's Membrane. In one patient with a perforation of Shrapnell's membrane the neck and the head of the malleus were visible. Under stroboscopic light the head of the malleus was seen to move out as the pars tensa moved in. This is in line with the observations in fresh cadaver ears, that the head of the malleus is above the axis of rotation and moves in a direction opposite to that of the drum and the malleus handle.

Observations on Retracted Drums. When there was definite retraction of the drum as in an acute negative pressure change in the middle ear, excursions of even the posterior segment were reduced below normal. A few millimeters of positive or negative static pressure on the outer surface of the drum produces a similar reduction in amplitude of the acoustic oscillations of the normal drum. The excursion could be definitely increased upon restoration of the drum to its normal position. Inequality of pressure on the two sides of the drum results in increasing the stiffness of the drum without changing its mass. This is more detrimental to its response to low frequencies than to high frequencies and is reflected in the reduced response to the 60 cycle tone used in this examination. Kessel[14] experimentally changed the stiffness of the drum in fresh cadaver specimens by pulling on the tensor tympani muscle. This also preferentially reduced the amplitude of drum movement to low frequency sounds (256 cycles) as compared to the higher frequencies 512 and 1024. While his experiment does not represent the exact manner of physiologic activity of the tensor, it does illustrate how increase in stiffness differentially affects the amplitude of vibration of the tympanic membrane. A sound loud enough to produce a crossed stapedius reflex in man (Bárány noisebox) was introduced in the opposite ear while observing the acoustic oscillations of the drum. No change in amplitude of drum movement was noted. This is comparable with other experimental observations on the middle ear muscles. The acoustic contraction of the muscles in an intact ossicular chain produces no visible displacement of the ossicles, but does increase the stiffness. However, no change in the stiffness characteristic of the drum itself would result and hence no effect on its amplitude of acoustic oscillation. The effect of this contraction on the acoustic oscillations of the ossicular chain could not be determined on the living. Experimentally on a

fresh temporal bone it is easy to show that there is a reduction in amplitude of oscillation of the chain, particularly of the malleus.

In one patient with the drum adherent to the head of the stapes acoustic movement of the stapes with the drum was visualized. Relatively good function was present in this ear, probably because of this contact between drum and stapes head.

Observations on Exudative Catarrh. The drum movement in a completely filled middle ear was reduced in amplitude and difficult to observe because frequently there was a lack of suitable light points. Where there was both fluid and air behind the drum, the sharp lines of fluid in a level or in bubbles afforded clearly defined landmarks for observing movement. A small displacement of the drum produced a much greater and more easily recognizable movement of the fluid. The level of fluid was sharply elevated, with each inward displacement of the drum. The oscillation in the middle ear fluid so induced by a 60 cycle sound was very striking.

Myringitis. Granulomas or bullae on the drum did not appear to diminish the amplitude of the drum movement to a 60 cycle sound. This is also in line with clinical observations on threshold tests in such cases. These show that changes in mass of the drum affect the high frequency responses, and do not produce a threshold drop for low frequencies.

DISCUSSION

The otologic student is confronted with the problem of explaining the exact nature of failure of function in the specific portions of the conduction system when auditory function tests show conduction deafness. Any method that helps to visualize under controlled conditions the acoustic movements of the visible elements of this conducting system, helps the student to gain some information about this problem. The amplitude of movement that can be produced in the drum with this sound source is easily visible. The movement of the malleus is more difficult to study.

CONCLUSIONS

1. The movements of the conducting elements of the ear for loud sounds at low frequency are so great as to be easily visible with a very low magnification.

2. A practical sound source and stroboscope are described which enables the otologist to examine with a Siegle otoscope the motion of the ear while it is reacting to a physiologic stimulus.

3. The acoustic movements of drum and malleus in the normal and in some pathological ears to a loud 60 cycle tone are described.

4. Observations with this equipment on the fresh human temporal bone amplify the findings in the living.

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REFERENCES

1. Politzer, A.: Untersuchungen über Schallfortpflanzung und Schalleitung im Gehörorgane in Gesunden und Kranken Zustande, Arch. f. Ohrenh. 1:59-73, 1864.

2. Lucae, A.: Untersuchungen über die sogenannte "Knochleitung" und deren Verhaltniss zur Schallfortpflanzung durch die Luft im gesunden und Kranken Zustande, Arch. f. Ohrenh. 1:303-317, 1865.

3. Politzer, A.: Zur physiologischen Akustik und deren Anwendung auf die Pathologie des Gehörorgans, Arch. f. Ohrenh. 6:35-44, 1873.

4. Buck, A. H.: Untersuchungen über den Mechanismus der gehörknochelchen, Arch. f. Augen. u. Ohrenh. 1 (part 2):121, 1870.

5. Mach, E., and Kessel, J.: Versuche über die Accommodation des Ohres Zitzungsberichte der Kaiserl. Akademie Wien 66 (part 3):337-343, 1872. Math. Naturwiss. Klasse.

6. Dahmann, H.: Zur Physiologie des Hörens; experimentelle Untersuchungen uber die Mechanik der Gehörknochelchenkette, sowie uber deren verhalten auf Ton and Luftdruck, Ztsch. f. Hals.-Nasen.-u. Ohrenh. 24:462-497, 1929.

7. Bekesy, G. V.: Uber die Mechanisch-Akustischen Vorgange beim Hören, Acta Otolaryng. 27:281-296, 1939.

8. Frank, O.: Die Leitung des Schalles im Ohr. Sitzungberichte der Königl., Akademie München Math. Phys. Klasse 11-77, 1933.

9. Wada, Y.: Beitrage zur Vergleichenden Physiologie des Gehörorganes, Pflügers Arch. f. d. ges. Physiol. 202:46-69, 1924.

10. Köhler, W.: Akustische Untersuchungen Zeitschr. f. Psychol. u. Physiol. d. Sinnes organ., Psychol. abt. 54:262, 1910.

11. Berthhold: Optische Darstellung der durch Schalleitung durch die Kopfknochen erzeugten Bewegungen des Trommel felles Am. Lebenden, Monatschr. f. Ohrenh. 6 (Part 3) 1872.

12. Mach, E., and Kessel, J.: Beitrage zur Topographie und Mechanik des Mittleohres Sitzungber. der Kaiserl., Akad. Wien, 69 (Part 3):221-243, 1874. Math. Naturw. Klasse.

13. Mach, E., and Kessel, J. Versuche über die Accomodation des Ohres, Math. Naturw. Classe Zitzungsber. Kaiser. Akad. Wien. 66 (Part 3):340-343, 1872.

14. Kessel, J.: Über den Einfluss der Binnen muskeln der Paukenhöhle auf die Bewegungen und Schwingungen des Trummelfells am todten Ohre, Arch. f. Ohrenh. 8:80-92, 1874. (Or new series, vol. 2.)

15. Lucae, A.: Das Oto-stroboscope und seine physiologische diagnostische Bedeutung, Arch. f. Ohrenh. 53:39-51, 1901.

16. Oertel, M. J.: Uber eine neue laryngostroboskopische untersuchungsmethode, Centralbl. f. d. med. Wiss. 16:81, 1878.

17. Spiess, G.: Ein neues Laryngostroboscop, Arch. f. Laryngol. 7:148, 1898.

18. Lucae, A.: Zwei physiologisch—akustische Vortrage gehalten auf der 73 Versammlung deutscher. Natur forscher und Aertze zu Hamburg in September 1901, Arch. f. Ohrenh. 54:268-277, 1902.

19. Frenckner, P. P.: Movements of the Tympanic Membrane and of the Malleus in Normal Cases and in Cases of Otosclerosis, Acta Otolaryngol. 27:587-607, 1939.

20. Frenckner, P.: A Method for Registering the Movements of the Tympanic Membrane in the Living Person, Acta Otolaryng. 27:707-712, 1939.

21. Wilska, A.: Eine methode zur Bestimming der Hörschwellen amplituden des Trommel fells bei verschiedenen frequenzen, Zkand. Arch. f. Physiol. 72:161-165, 1934.

22. Kobrak, H.: A Cinematographic Study of the Conduction of Sound in the Human Ear, J. Acoustical Soc. of America 13:179-181 (Oct.) 1941.

23. Kobrak, H.: Direct Observations of the Acoustic Oscillations of the Human Ear, J. Acoustical Soc. of America 15:54-56 (July) 1943.

XLIII

RECURRENT SEVERE HEMORRHAGE FROM THE NOSE AND PHARYNX

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The otolaryngologist is compelled to devote considerable time and thought to hemorrhage, but with the exception of massive hemorrhage from the pharyngomaxillary fossa, this subject receives relatively little attention in the literature. It is my intention to discuss briefly that type of massive recurrent hemorrhage which is the result of the erosion of a blood vessel beneath the surface where the source of the bleeding is not immediately evident. Consideration of the underlying pathological changes demonstrates why such bleeding is usually arterial rather than venous. The connective tissue surrounding a blood vessel is weakened by the infectious process which invades the arterial wall. Nature attempts to forestall hemorrhage by thrombus formation, which attempt is more likely to fail when the vessel is a sizable artery. Cerebral embolism should be at least as common a complication of this pathological process as is hemorrhage, yet Kernan,[1] reporting complications in 320 cases of peritonsillitis, named hemorrhage in six, cerebral embolism in none. In my own practice, cerebral embolism has occurred more frequently than massive hemorrhage as a complication of peritonsillar abscess, the ratio being 5 to 3.

Hemorrhages originating in the pharyngomaxillary fossa have received more attention than those from other regions. In 1933 Salinger and Pearlman[2] reported 231 cases of all types of hemorrhage in this region. They concluded that ligature of the common carotid was the treatment of choice. Autopsy reports of fatal cases showed the internal carotid artery to be the one usually eroded. Erosion of the external carotid, the superior laryngeal and the ascending pharyngeal arteries was also reported.

While ligature of the external carotid artery is not dangerous, ligature of the internal or the common carotid artery may cause loss of consciousness or hemiplegia. There is a 15 per cent mortality rate.

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However, in cases of massive recurrent hemorrhage in which the artery is not ligated the rate of mortality is 60 to 80 per cent.

I will briefly outline four successful cases and then attempt to give in detail a fatal case which illustrates some important points.

REPORT OF CASES

CASE 1. The first case is of a boy of 12 complaining of left-sided earache and swollen left cervical glands. The ear canal was filled with blood and the left tonsil was pushed forward. Cervical adenitis secondary to a furuncle of the canal was the house officer's admission diagnosis. Successive increasingly severe hemorrhages appeared to come from around the left tonsil. At the end of three weeks in the hospital, Horner's syndrome appeared as the cervical swelling increased in size. The case was diagnosed as internal carotid aneurysm. That vessel was tied and the patient recovered.

CASE 2. A 34-year-old woman with a history of 14 peritonsillar abscesses supplies a good example of bleeding following peritonsillar infection. Her family physician had opened her peritonsillar abscess the day before she was hospitalized. In the four days following admission she had one slight and two massive hemorrhages, despite packing of the pharyngomaxillary fossa through the incision. Following the third hemorrhage she was given a transfusion and the right external carotid was tied with silk and a loop placed around the internal carotid. This operation was performed with the patient's hemoglobin at 20 per cent. Four months later, when the tonsils were removed, there was still a well defined cavity measuring about 4 cc. directly behind the right tonsil.

Massive recurrent hemorrhage may occur from the sphenopalatine branch of the internal maxillary artery on the floor of the nose and the same method of treatment applies. Cases 3 and 4, illustrating this point, are presented.

CASE 3. A male aged 16 years,, was struck on the nose by a baseball three days before admission to the hospital. He bled severely from the left nostril prior to admission. On examination both nostrils were found packed with blood-soaked cotton pads. X-ray showed an irregular fracture of the nasal bone with slight outward displacement. His blood pressure was 82/70; his hemoglobin, 6.2 gms. Repeated nasal packing failed to control the bleeding. He had three hemorrhages in the course of two days, and three transfusions. In spite of transfusions the blood pressure and hemoglobin percentage continued to drop. The external carotid on the left was ligated.

This effectively stopped the bleeding despite the fact there had also been bleeding from the right nostril.

CASE 4. This is a case of a 22-year-old male who developed bleeding from the base of the septum on the left side five days after a submucous resection. The nose was packed and the packing was removed the next day. There was no bleeding. The following day a massive hemorrhage occurred which was controlled by another very tight pack using long vaseline gauze strips. He was hospitalized. The following day he started to bleed through the packing. The packing was removed and another packing inserted but by this time the patient's condition was very poor. He developed obvious air-hunger and finally had a convulsion and became unconscious. A blood transfusion was given and the external carotid on the left side was immediately tied. There was no further bleeding.

This case and the preceding one illustrate bleeding from the floor of the septum which was completely controlled by ligation of the external carotid on one side only. The rich anastomosis of vessels in this region did not cause further bleeding after one vessel was tied.

CASE 5. This case of fatal hemorrhage illustrates a tragedy of errors. A boy of 12 came to the hospital with the following history: Swelling in the right side of neck developed three weeks ago. Four days previously a peritonsillar abscess was opened. Last night he bled and was referred for hospitalization. On admission he was described as a pale, slender, white boy of 12 who had difficulty in breathing and talking. Large swollen cervical glands on the right side of neck and Horner's syndrome were present; i.e., he had drooping of the right upper lid and a contracted pupil on that side. His red blood count was 3,390,000; hemoglobin, 11.5 gms.; white blood count, 20,000. The intern probed the incision and found no pus or blood. He had received a fairly large amount of sulfadiazine at home, and in the hospital was put on penicillin. He was improving but on the third day after admission he had a massive hemorrhage from the throat. The blood pressure was 60 systolic. He received 500 cc. of blood and 250 cc. of plasma. Improvement continued, the swelling subsided, the blood pressure had risen and the temperature was normal on the 15th day after admission. On this day he had another massive hemorrhage and was referred to the Surgical Service for ligation of the common carotid. The external carotid was ligated and a loop was placed around the common carotid. The surgeon was not thoroughly convinced of the necessity for drastic action nor was he frightened by statistics on internal carotid ligation. The patient was then given 500 cc. and 1000 cc. of whole blood. Eight days later he had another massive

hemorrhage. An intern was called who stopped the bleeding by pulling on the loop around the common carotid. Two more transfusions of 500 cc. of plasma were given.

It is easy to say now that right here the common carotid should have been tied.

He was now on the Surgical Service and in the daily notes the notation for the 38th day in the hospital states: "Up today, home tomorrow." That night he lost 3000 cc. of blood in ten minutes and expired. The ligature around the common carotid had disappeared.

For postmortem examination, permission was obtained only for re-opening the wound. No ligatures were found. All the veins and arteries were opened and a probe passed in both directions with care. Circulation in the external carotid had been re-established. Nylon was the suture material used 22 days before.

We may expect that with the advent of penicillin and sulfonamide therapy, hemorrhage following infection will be materially reduced. This patient, however, was treated adequately with penicillin and sulfadiazine, but after the erosion of a large vessel had taken place. He lived 42 days after his peritonsillar abscess was opened, the last 38 in a hospital. During much of that period his condition was satisfactory. His hemorrhages were far apart. His systolic and pulse pressures were low, probably naturally so. He was a favorable case to invite temporizing procedures.

There is sufficient ground to doubt the original diagnosis of peritonsillar abscess in this case. The presence of Horner's syndrome, the intern's success in arresting hemorrhage by pulling on the ligature around the common carotid, the failure of the ligation of the external carotid to prevent bleeding, and the patient's age are points against but do not prove the absence of peritonsillar abscess. Peritonsillitis is more likely to erode the external carotid or its ascending pharyngeal branch, but has been known to involve the internal carotid. It would appear that in the presence of strong evidence that the side wall of a sizable artery is eroded, immediate ligation is the only defensible treatment, regardless of the apparent success of less drastic measures.

124 WATERMAN STREET.

REFERENCES

1. Kernan, J. D.: Bull. New York Acad. Med. 17:624 (Sept.) 1941.

2. Salinger, S., and Pearlman, S. J.: Hemorrhage From Pharyngeal and Peritonsillar Abscesses, Arch. Otolaryng. 18:464 (Oct.) 1933.

XLIV

AERO-OTITIS MEDIA

A FURTHER REPORT OF PURULENT OTITIS MEDIA COMPLICATING AERO-OTITIS MEDIA

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Aero-otitis media has assumed a considerable importance in this war. Many airmen needed in combat have been grounded because of this condition, some of them permanently.

For this reason it seems fitting to report on some observations concerning areo-otitis media as seen at an Army Air Base and Preflight School. Another purpose of this paper is to report further on purulent otitis media as a complication of aero-otitis media. Thirty-nine cases of this complication have been studied here. No other cases have been recorded in the literature as far as I am aware except in previous papers by the author.[1, 6]

The effects of altitude on the middle ear have been recognized for many years, but have recently been of greater concern in military and commercial aviation.

The ear symptoms experienced in flight can be briefly described as follows: During ascent there are usually no disagreeable symptoms, there being only a feeling of fullness and diminished hearing followed by a clicking sensation with clearing, as air in the middle ear, now under greater pressure than the surrounding air, passes down the eustachian tube. When level flight is reached no further inequalities exist between the air in the middle ear and that of the outside, and no symptoms are experienced. It is seldom that this equalization is not accomplished on ascent. Descent is the critical time for the development of the ear symptoms. While any sufficient inequality between air in the middle ear and air of the surroundings will cause symptoms of stuffiness, pain, and hearing loss, actually this inequality only occurs on descent, except in rare cases. Thousands of cases have borne out the almost exclusive role played by descent.

Of the factors which are responsible for the production of aero-otitis media the anatomical structure of the eustachian tube is most

important. This is illustrated by considering the sinus structure in comparison. Because the sinuses are served by bony rigid openings or ducts and not by a collapsible structure such as the eustachian tube, aerosinusitis is only about one-fifth as common as aero-otitis media. It is not because of absence of disease about the sinuses.

The eustachian tube may be divided into an upper bony part and a lower cartilaginous and membranous part, the latter opening directly into the nasopharynx. The upper or middle ear part is bony and rigid; the mucosa is very thin and firmly attached to the underlying bone. Air seeking to escape from the middle ear when under greater pressure than the air of the surroundings can easily do so because of this rigid funnel down which it can pass with little obstruction. The lower or pharyngeal end of the eustachian tube is cartilaginous and membranous in construction, and has a folded, loosely-attached mucosa in which glands and even lymphoid tissue are found. It normally lies closed and can easily be kept so by an increasing outside pressure during descent. It is subject to inflammations from the surrounding structures, such as lymphoid tissue of the pharynx, the adenoid and the tonsil, and the infectious material from the sinuses which may pour over it.

Another factor of importance is the increasing density of air encountered on descent. Heavy air does not gain entrance easily to the middle ear. The lighter air on ascent facilitates air exchange for middle ear ventilation. Patency or closure of the eustachian tube during flight has not only to do with its structure and inflammation, however, but also with the rate of descent, which is all important.

As is well known to otologists, an aero-otitis may occur from a slow descent by railroad down a mountain for example, which would not be over a few feet a minute, but in the presence of inflammation about the torus tubarius, the tube may be closed and air of decreased density may be trapped in the middle ear. This aero-otitis may not have the violent onset or severe ear pain, but will have many of the same characteristics. Two histories are here presented which illustrate aero-otitis produced in actual flight by rapid descent in flyers never previously experiencing trouble at slower rates. A pilot was flying a pursuit plane in Africa at about 10,000 feet when he dove for an attack in excess of 6,000 feet a minute. In the tenseness of the moment he experienced no pain, but in retrospect he remembers that his ear popped and he believed that he had broken his left ear drum. A day following this incident there was a discharge from the left ear which persisted. There was a slight cold existing before the flight. There

had been no previous attacks of aero-otitis media, but the rate of descent had not been so rapid.

Another case illustrating the same factor of rapidity of descent, but with more striking symptoms, is the following: A bombardier was in a plane over Europe when the rear oxygen tank was shot away. There being no reserve tanks in the ship a very rapid descent was made from 24,000 feet to 5,000 feet. There developed a very severe pain in both ears which he describes as a feeling as though the drums were being torn out. The only thing he could think of, to obtain relief, was to get out of the plane which he tried to do. There was dizziness and weakness following the landing and he became unconscious then and again a few hours later. There was no cold and no sinusitis prior to the flight. He had had no trouble in previous flights, but the rate of descent was not so rapid.

Another mechanical or physiological factor tending to produce or augment aero-otitis media in the presence of tubal closure is absorption of oxygen from the middle ear. If tubal obstruction is present, the air which is trapped in the middle ear is subject to decrease in volume by absorption of the oxygen by the blood stream. This may produce or heighten an already existing negative pressure within the middle ear which in turn will produce symptoms.

Predisposing Pathological Changes Responsible for Aero-Otitis Media. In general, upper respiratory infections, nasopharyngitis, sore throat, colds and sinusitis account for most of the acute conditions which are complained of as the predisposing cause. This is, of course, a general statement which is well known. Of a greater and more specific interest are the findings in the epipharynx; there is almost a constant pathological picture which is best seen with the nasopharyngoscope. For descriptive purposes a composite picture is presented. The torus tubarius almost always shows marked inflammatory changes. The inflammatory swelling is most usually about the anterior lip where the mucosa does not seem so firmly bound to the underlying structures. The inflammation often obliterates the tubal orifice completely. A most constant finding is adenoid tissue in the vault extending laterally where it impinges on the torus tubarius. There is frequently adenoid or lymphoid tissue anterior to the tubal structure and sometimes it is seen in the tubal opening. The adenoid tissue usually just covers the triangle made by the rostrum of the sphenoid and does not extend to an obstructive position. This lymphoid tissue is usually the site of a varied amount of inflammation, sometimes marked in extent. Often adenoiditis exists and frequently the entire area is covered by discharge. Very often there is little to be seen

in the throat and almost nothing in the anterior part of the nose and one would be at first surprised to find so much in the epipharynx. The patients are not aware that there is anything amiss in the region as they usually have no symptoms other than aural or nasal symptoms. The posterior tips of the inferior turbinates are so frequently edematous and show polypoid changes that it seems almost the rule. The turbinates in themselves, I believe, do not influence the tubal structures to any extent, but they are important as expressions of some other disease, such as sinusitis, which influences both the turbinate and the tube. The above pathological picture has been found in almost all cases of aero-otitis media and I now look on it as almost a constant finding. The adenoid tissue seems the most important part of the findings, as it is sensitive to inflammation and swelling with the consequent possibility of eustachian closure.

The pathological picture described above is not new as it has been described as being the responsible factor in eustachian catarrah and as being responsible for most of the deafness in children. From this knowledge, it might have been expected that this would also be true in aero-otitis media. This is, however, in retrospect and was only brought home to me after the examination of hundreds of cases of aero-otitis media.[1] The adenoid tissue in the quiescent stage is not necessarily obstructive to the tube. I have seen many cases of aero-otitis media occurring for the first time after hundreds of hours in the air as a result of inflammation in this region. When it again subsides, no trouble is experienced. The presence of this tissue is always a menace, however, as it is subject to inflammation. Fowler[9] found a great number of flyers in England suffering from otitis media and aero-otitis media. In these cases hyperplasia of the pharyngeal lymphoid tissue seemed to account for the condition. I have seen many such cases here in men who have been returned from the European Theatre because of this condition. There are occasional exceptions to the above stated etiology. I have seen several cases in which a posterior sinusitis was the only causative finding. There was one or two cases in which nothing could be found to account for the persistent aero-otitis. A history of otitis media in childhood was elicited and it is possible that some partial stenosis resulted at that time.

Other causes of stenosis of the eustachian tube mentioned in the literature are scar tissue about the tubes from adenoidectomy, and malposition of the mandible. Scar tissue was not found in many of the cases seen here though, if present, it would most likely cause difficulty. I have had no experience with mandibular malposition as a cause of aero-otitis.

Septal deviations in themselves did not seem of any importance as a cause. For interest's sake, a hundred or more patients with the most marked septal deviations were sent into the low pressure chamber prior to operation. They developed neither aero-otitis media nor aero-sinusitis. In the cases of aero-otitis media septal deviations did not stand high as a possible cause.

Frequency. The incidence of aero-otitis media here is about six per cent taken over a period of a year. Over 150,000 flights have been made. By comparison the incidence of aerosinusitis is a little over one per cent.

Symptomatology and Pathological Findings in the Ear. The first symptom of importance is pain which may be very moderate to extremely severe, Patients have characterized the pain as, "the sharpest pain I have ever had" or "almost frantic with pain." Most of the men seen from the low pressure chamber have mild symptoms because the flight is interrupted when the pain becomes acute, and if necessary, an ascent is made in an effort to equalize the pressure. It is possible that the pain may be so severe as to cause unconsciousness and shock. There may be nausea, vomiting and dizziness, as occurred in the case already mentioned. Some labyrinthine damage would seem inevitable with such a violent accident as a traumatic rupture of the drum. The location of the pain is usually described as being deep in the ear, but may also be either in front of the ear or over the mastoid region. In my experience, the pain, even though severe for a time, is of short duration and is then followed by the other symptoms of stuffiness and loss of hearing. After the pain disappears, there is a stuffiness or full feeling which may persist for a considerable time without treatment.

The appearance of the drum usually parallels the symptoms. With marked pain the drum is usually hemorrhagic, retracted and rather severely altered in appearance. The hemorrhage is in the layers of the drum itself or into the middle ear. Often the drum will appear to be one sheet of hemorrhage without other marked changes. The retraction is not great at first and the thickness of the drum is often not altered. This hemorrhage undergoes the usual changes in color, becoming deeper red and then a dark blue. The drum may be a deep blue color, only the ossicles standing out white against this background. In a period of about twenty days, a complete fading takes place and the drum returns to its former luster. When the process is moderate, there is only reddening along the handle of the malleus and around the periphery, as in a beginning otitis media. Drums which have been involved in an old otitis media show multiple changes

when they are subjected to an aero-otitis media. When there has been a thinning of the drum or when there have been perforations which have healed by thin scar tissue, the appearance of the drum is often striking if there is an aero-otitis superimposed. In marked cases, the ossicles seem to stand out almost nakedly, the thin drum membrane appearing to be draped around them, unevenly falling away toward the medial wall under the influence of the negative pressure in the middle ear. There may be many light reflexes because of the uneven contour. Small healed perforations are seen as pits with the light reflex at the bottom. There have been many instances of these scar tissue areas opening on descent without pain and with relief of the symptoms. These traumatic perforations have healed without difficulty but will probaby recur under any barometric stress.

Hearing loss is another prominent symptom. The degree is usually moderate. The appearance of the drum does not always correspond to the degree of the hearing loss. There is no characteristic curve, but the type of deafness is conductive. Even with the greatest losses the hearing returned to acceptable limits in two to three weeks without treatment. In only a few cases has the hearing failed to return to a nearly normal level. These men have not had audiometric checks before the flight and no exact determination of return to normal can be made. The entrance test is a spoken and whispered voice test. There are frequently found high tone losses which do not come back, while the low tone losses return. These, I believe, are old losses. In some cases a definite history of noise trauma over a considerable period of time is elicited. Often the areo-otitis media is unilateral, while the high tone loss is bilateral. Further study will be necessary before these high tone losses can be excluded as arising from the aero-otitis. The Rinne test in aero-otitis media is negative and the Weber is usually lateralized to the affected side.

Very often there is a resonance change, the patient's own voice sounding distant or as though he were talking into a barrel.

In most every case of aero-otitis, there is sooner or later fluid in the middle ear. The production of fluid is interesting. The negative pressure is responsible. The fluid is drawn from the blood vessels of the middle ear and is a transudate. I have never seen any experimental proof of the origin but this is thought to be the case. The fluid is of a brownish-orange color, of rather thin consistency. In cases where a perforation develops after the negative pressure has existed for some time, the fluid will drip from the ear or be found in the canal. If the middle ear is examined immediately after the aero-otitis media de-

velops the fluid is not often found. It is almost always found after several hours and is quite a constant feature of the disease.

The middle ear is able to absorb oxygen readily, thus increasing the relative negative pressure existing with an increase in the transudate and retraction of the drum. The hearing loss may also increase when this takes place. This condition of negative pressure with a fluid formation is not peculiar to aviation or even to any altitude changes. In any condition where there is an occlusion of the eustachian tube, a negative pressure may cause an accumulation of fluid, the so-called serous catarrh. The fluid never fills the entire middle ear but strikes a level equivalent to the negative pressure which draws it out. As the fluid increases, the negative pressure is lessened by compression of the air and the transudation ceases. The fluid appears as one or several dark fluid level lines behind the drum. The fluid may also appear as bubbles in the middle ear. The position of the fluid may shift with inflation or a change in posture and the hearing may decrease or increase as the fluid moves over or away from important structures.

Treatment. The treatment may be divided into three phases: first, preventive; second, actual treatment of the developed condition; and third, the remedy of the underlying pathological condition in order to prevent future occurrences.

No difficulty should arise if no marked upper respiratory pathology exists and the subject is aware of the possibility of ear blockage and is taught one of the various methods of opening the eustachian tube. Very often a person having difficulty on the first flight will have no trouble on a second made almost immediately, as he has acquired the knack of opening the tubes. Before the flight, it is the practice here to have all men with any indication of upper respiratory infection ventilate the middle ear by the Valsalva method, the examiner watching with an otoscope to see if the inflation is successful. Despite the continual high incidence of upper respiratory infections seen here, this procedure of inflation has resulted in no difficulty so far as I have been able to observe. This would rather refute the extreme precaution of otologists regarding inflation during respiratory diseases.

In the acute condition aero-otitis media seen here did not demand much in the way of relief. The pain has almost invariably disappeared on arrival at the clinic. The stuffiness persists, but not to a very disagreeable extent. Inflation usually helps, particularly after some days have elapsed and the hearing loss and the stuffiness persist. Ogden[7] found that inflation from a continuous source of compressed

air was of great value in relief of symptoms. He has used this in a great number of cases with no untoward results in spite of the inflammation. Spiegel[8] used inflation with helium with good results by the same method devised by Ogden. The hemorrhage in the drum is not subject to any improvement by treatment, but resolves in a relatively short time with no ill effects. The fluid usually is absorbed or passes down the tube as the ear regains its ventilation. As is well known to otologists, the fluid collection in the middle ear in serous catarrh may be very difficult or impossible to clear up. It may exist for years. Although the two conditions are similar in the mechanism and the pathology, the cases of aero-otitis media I have seen thus far present no problem as to fluid.

As stated previously, but emphasized here, the adenoid tissue seems to be the all important pathologic factor in the production of aero-otitis media. This tissue is acutely inflamed by upper respiratory disease, which may be a sinusitis or a nasopharyngitis. However, the men having only respiratory disease without the adenoid tissue rarely suffer from aero-otitis.

The treatment to prevent future attacks of aero-otitis is then aimed at the elimination of adenoid issue. If a large mass of adenoid tissue is found, it is removed surgically. If the adenoid tissue is around the tubes and in the vault, which is its usual location, it is treated by irradiation in fractional doses. Radium has not been available to us here, so x-ray therapy is substituted. Those treated have responded well. It is too early to report on the entire results, but I may say that many men having repeated attacks of aero-otitis media have been freed of any difficulty on subsequent flights by such treatment. This work on the radiation of adenoid tissue for deafness caused by eustachian occlusion was initiated by Crowe and Baylor and is now established on a firm basis.

PURULENT OTITIS MEDIA COMPLICATING AERO-OTITIS MEDIA

Several months ago several cases of purulent otitis media occurring as a complication of aero-otitis media were reported.[1, 6] Additional cases are now reported as illustrative of this complication.

Armstrong and Heim,[2] in their original paper on aero-otitis media in which they proposed the now accepted name, state under the heading of complications:

"While trained pilots usually try to avoid flying during periods when they have an acute infection of the upper respiratory tract, because of the discomfort and pain in the ears, which almost invariably occurs, nevertheless a considerable amount of such flying has been done. It might naturally be expected in these cases

that during descent, the intermittent blasts of air from the pharynx to the tympanic cavity would carry with it septic material to the mechanically irriated tympanum and readily set up an acute inflammatory process. While it is possible or even probable that this septic material is carried to the tympanum, we have never seen it, nor are there any reports in the literature of this having occurred."

Armstrong, in his book on aviation medicine[3] published in 1939, makes the same statement. Campbell,[4] in an excellent article discusses all phases of the problem but does not mention this complication. As far as I am aware, no mention is made of this possibility in any of the numerous articles dealing with aviation medicine in relation to the ear.

Requarth,[5] in an article discussing aero-otitis media in compressed air workers and the results of helium-oxygen mixture in its treatment, states that "in the group so treated 1.5% progressed to suppuration of the middle ear while in the control, 4.5% developed suppuration." The use of the term aero-otitis media is interesting. It was first suggested as expressive of certain ear changes and symptoms occurring during flight. There, naturally, is considerable in common, though the differences in atmospheric pressures and rates of descent are quite marked.

At the time of this writing I have recorded 39 cases of purulent otitis media following aero-otitis media. Eight cases have already been reported.[1, 6] As about 150,000 man-flights have been made, these 39 cases still indicate a very low incidence of this complication.

For the sake of brevity, only a few of the more typical cases will be given.

REPORT OF CASES

CASE 1. On July 8, 1943, an aviation cadet made a routine flight to 38,000 feet in the low pressure chamber. There was no trouble on ascent but on descent when he was at about 20,000 feet, his left ear became slightly painful and stuffy. From this time on this ear did not open; the hearing remained muffled and it felt as though there were water in the ear. On July 11, pain developed in this ear and by morning was very acute and almost unbearable. He reported to the hospital for relief.

Examination. The man was in obvious pain. His temperature was 101° F. The left ear drum was reddened and bulged with no normal landmarks visible. The right drum was normal. There was a slight congestion in the nose, with a slight septal deviation to the left side. The tonsils were out. No pharyngitis was present. By

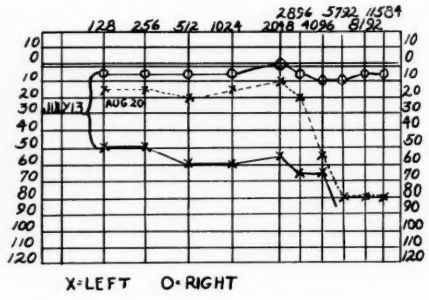

Fig. 1.—Audiogram, Case 1.

mirror examination there was seen a central inflamed adenoidal mass which extended laterally to the tubal structures. There was marked hearing loss.

Treatment. Paracentesis of left drum was done.

Course. The pain and fever were relieved following the paracentesis. The discharge was profuse. On July 16, a partial left facial paralysis developed which deepened to complete peripheral paralysis the following two days. A mastoidectomy was done because of the persistent paralysis. No frank pus but a considerable amount of infected granulation tissue was found.

Comment. This case is given in more detail because of the added interest of facial paralysis. No discussion of the facial paralysis and its indication for operation will be gone into as it deviates from the subject of the paper.

The ear which became painful and stuffy during the flight was the one to become abscessed. The incubation required about 70 hours. He stated that he was free from any respiratory infection, but examination of the epipharynx showed boggy adenoid tissue and edema about the tubes.

CASE 2. On the morning of May 27 an aviation cadet was on a routine flight to 38,000 feet. There was no difficulty on ascent or while at that altitude. On descent when he was at about 25,000 feet the right ear became stuffy and, although partially ventilated, it was never completely opened. The morning of the 29th, the right ear became painful and he reported to the ear clinic with moderate pain.

There was only reddening of the drum with no distortion of the landmarks and no bulging. He was advised to enter the hospital if there was increase in pain. The pain increased the same day and he entered the hospital. A spontaneous discharge began shortly after entry. He had had a slight head cold.

The past history revealed no ear or sinus trouble.

Examination. The right ear drum was reddened and thickened and no normal landmarks were apparent. There was a purulent discharge. The left drum was retracted and dull. The nose was congested and a slight discharge was present. His tonsils were of considerable size and boggy. There was adenoid tissue in the vault and along the lateral walls. There was discharge in the epipharynx. The openings of the eustachian tubes were narrowed by congestion. By June 14, the hearing was up to passable limits. The ear was dry with a normal drum.

Comment. In this case the incubation period was about 48 hours. The side of the difficulty in the low pressure chamber was the same as that of the abscess. There was a slight cold, but the adenoid tissue in the epipharynx and the throat was inflamed.

CASE 3. On the morning of June 16, an aviation cadet went on a routine flight to 38,000 feet. There was no difficulty on ascent but on descent both ears were stuffy, but not painful. He states that he did not manage to clear either ear during the flight or afterward. At eleven o'clock on the evening of the same day there began a pain in the right ear which became rather severe. He waited until the following day to go to the dispensary. At noon, June 17, there began a spontaneous discharge from the right ear with a relief of pain. He was hospitalized shortly after the discharge began. He complained that he had had a cold intermittently for about four months.

There was no history of ear or sinus trouble in the past.

Examination. The right ear drum showed a considerable reddening and there was a myringitis bullosa. There was a copious discharge. The left drum showed retraction and a fluid level line. There was some hypertrophy of the lateral bands. The tonsils were out cleanly. There was discharge and congestion about the right eustachian orifice. There was adenoid tissue in the vault which extended laterally into contact with the tubes. The opening of the left tube was found clearer than the right. The nose showed some congestion and discharge. Sinus x-ray films were essentially negative.

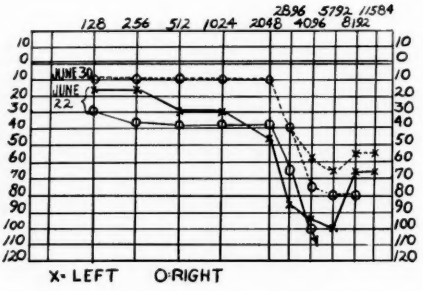

Fig. 2.—Audiogram, Case 4.

Course. By July 6, the drum was about normal and the hearing within normal limits.

Comments: The tubal occlusion produced in the low pressure chamber resulted in a purulent otitis media on one side within 16 hours, and a mild aero-otitis media on the opposite side. Again the epipharynx and its adenoid tissue which were inflamed by a respiratory infection seemed to be the site of the disease.

CASE 4. On June 10 an aviation cadet was in the low pressure chamber on a routine flight to 38,000 feet. There was some difficulty with ear pain and stuffiness on both sides all the way down. The stuffiness continued all that day with no ventilation possible. The following day, 24 hours after the flight, ear ache began on each side which became very severe and climaxed in a bilateral spontaneous rupture. He was hospitalized when he presented himself in this condition.

On June 7 he had been discharged from the hospital where he had suffered from a tonsillitis for five days. He believed he was entirely well.

Examination. Both drums were reddened and thickened with no normal landmarks. There was purulent discharge from both. His temperature was 101° F. There was adenoid tissue in the vault and along the lateral walls, which was boggy and infected. The tubal openings were edematous. The tonsils were in and were somewhat inflamed. There was marked loss of hearing by whispered voice test. The nose and the sinuses were essentially negative.

Course. By June 30, the drums were healed and dry, though not entirely normal. The hearing was up to normal except for the high tones. He gave a history of work in an extremely noisy place around airplane motors for five months before entrance into the Army.

Comment. Both ears were involved during the flight and both became abscessed. The incubation time was about 24 hours.

SUMMARY

A discussion of aero-otitis media is presented as it is seen in a military aviation age group of 18 to 27. The statement is made that the adenoid and lymphoid tissue in the epipharynx is the outstanding pathological agent in the cause of the condition. This tissue is easily inflamed by any upper respiratory disease. This does not mean that this is the only pathological entity responsible, but that it is predominant in this age group. I believe it accounts for the high incidence of aero-otitis media. In older age groups where there is an atrophy of lymphoid tissue, there may be a different picture. I have never had the opportunity of examining a large number of cases in this group.

Treatment by x-ray or radium has been instituted and I believe will show the good results which have already been demonstrated in the treatment of deafness in children which exists on the same pathological basis.

Thirty-nine cases of purulent otitis media, occurring as a complication of aero-otitis media, have been observed here.

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REFERENCES

1. Wright, R. W.: Some Observations in Aero-Otitis Media. Report on Several Cases of Purulent Otitis Media Complicating Aero-Otitis Media, Santa Ana Flight Surgeon, vol. 1 (May) 1943.

2. Armstrong, H. G., and Heim, J. W.: Effect of Flight on the Middle Ear, J. A. M. A. 109:417-421 (Aug. 7) 1937.

3. Armstrong, H. G.: Principles and Practices of Aviation Medicine, Baltimore, Williams & Wilkins Co., 1939.

4. Campbell, P. A.: Aviation Medicine with Reference to the Ear and Upper Respiratory Apparatus, The Year Book of Eye, Ear, Nose and Throat, 1941, p. 355.

5. Requarth, W. H.: Aero-Otitis Media in Compressed Air Workers: Treatment with Helium-Oxygen Mixtures, J. A. M. A. 116:1766 (April 19) 1941.

6. Wright, R. W.: Aero-Otitis, Complicated by Purulent Otitis Media, Air Surgeons' Bull. 1:8 (June) 1944.

7. Ogden, F. W.: Politzerization—A Simple and Effective Method in Treatment of Aero-Otitis Media. Air Surgeons' Bull. 1:18 (April) 1944.

8. Spiegel, F. S.: Aero-Otitis Treated by Inflation with Helium, Air Surgeons' Bull. 1:9 (June) 1944.

9. Fowler, E. P.: Use of Radon to Prevent Otitis Media Due to Hyperplasia of Lymphoid Tissue and Barotrauma (Aero-Otitis), Arch. Otolaryng. 40:402-405,

XLV

ACOUSTIC TRAUMA

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On July 24, 1942, at the Station Hospital, Fort Benning, Georgia, surgico-medical meeting I reviewed acoustic trauma to show that the main damage has its beginning above the spoken voice range of from 300 to 3000 d.v. per second and is therefore often not detected by the individual, and that the beginning loss of hearing from acoustic trauma usually starts with a depression in the curve of hearing around 4096 d.v. per second; also that this loss of the higher tones, as the acoustic insult continues, encroaches upon the speech range, highest tones first. Glycerine-treated or plain cotton placed in the ear canals was shown to diminish noise penetration by 20 or more db. of intensity, depending on the efficiency with which it was placed in the ear canals.

On November 6, 1943, at the Franco-American-British Medical Corps Clinical Conference at Oran, Africa, I presented an acrylic mold to be worn in the concha of the ear, such as is used on a large scale in certain industries during the present war, but it was considered impracticable in the armed forces.

To diminish the intensity of loud high frequency noises or explosions yet permit loud conversation and earphone reception, it is suggested that the ear canals be plugged with cotton and also that a chamois ring in a soft leather helmet, as worn by British aviators, be made to rest on the head around the external ears; earphones may be incorporated when necessary. In training periods such routinely instituted precautionary measures would diminish much acoustic trauma, so that at the front hearing acuity would be at its best.

At the Mediterranean Base Section Clinical Conference, August 14, 1943, I summarized 115 cases of blast injuries incurred in action (North African and Sicilian Fronts) observed from January through July 1943 to emphasize the hearing improvements, and the drumhead and middle ear healing which took place.

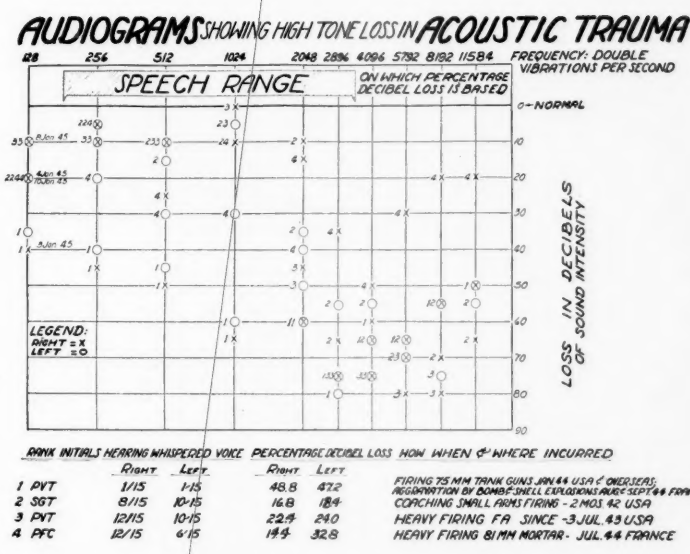
Practically all of the patients in this survey were considered to have sustained nerve or perceptive deafness, although 68 had per-

foration of one or both ear drums and 25 of these had suppuration in one or both middle ears. Any middle ear infection or drumhead perforation had usually subsided or healed but the hearing defect remained. On this basis, without confirmatory audiometric studies, the main damage was considered to be to the nerve or end-organ. One hundred sixty-five of these acoustic injuries were incurred by shell explosions, 59 by firing in action, 30 and 17, respectively, by land mine and bomb explosions, 14 by firing in practice, and 5 by dynamite, nitroglycerine or grenade explosions.

The 310 cases of acoustic trauma which came to otologic consideration comprised only about 8 per 1000 of 21st General Hospital's admissions in the period January 1943 to July 1944. Forty-two patients were designated by Boards of Officers for evacuation to the Zone of Interior and 25 of these, considered without reasonable doubt to have entirely nerve or end-organ involvement, could hear, on an average, low conversational voice at a little over three feet in either ear. Eighty-seven were designated by Boards of Officers for permanent limited service duty, and 34 of these, with bilateral hearing defects probably solely due to nerve or end-organ involvement, averaged a hearing of eight feet for low conversational voice in either ear. The majority, or 181 of the 310 soldiers, returned to general service duty, with an average hearing loss of four feet for low conversational voice in either ear.

Thirty-two of the 310 cases had had trouble with the ears or hearing prior to service. Permanent aggravation took place by military service in all but two of these. It is known that individuals with recurrent suppurative otitis media or chronic nonsuppurative otitis media, who may have scarring of the drumhead or adhesions of the medial tympanic wall, have lost much of their normal protective mechanism against acoustic shock.

One patient appeared to have no impairment of hearing according to the standard of 20 feet for low conversational voice. He did have, following the shell explosion, traumatic perforation of the ear drum and tinnitus, the latter a frequent symptom, justly of great concern, relief from which must be mainly spontaneous. The minimal high tone involvement sustained in this case could only have been shown by audiometric testing but an audiometer was not available. At times, especially in the younger individuals, the permanent improvement in hearing following acoustic trauma proved astonishing and the maximum improvement usually occurred in two months or less. Fowler's solution (liquor potassii arsenitis) was given in increasing


AUDIOGRAMS SHOWING HIGH TONE LOSS IN ACOUSTIC TRAUMA
128 256 512 1024 2048 2896 4096 5792 8192 11584 FREQUENCY: DOUBLE VIBRATIONS PER SECOND
SPEECH RANGE
ON WHICH PERCENTAGE DECIBEL LOSS IS BASED
0-NORMAL
10
20
30
40
50
60
70
80
90
LOSS IN DECIBELS OF SOUND INTENSITY
LEGEND: RIGHT = X LEFT = O
RANK INITIALS HEARING WHISPERED VOICE PERCENTAGE DECIBEL LOSS HOW WHEN & WHERE INCURRED
RIGHT LEFT RIGHT LEFT
1 PVT 1/15 1-15 48.8 47.2 FIRING 75 MM TANK GUNS JAN 44 USA & OVERSEAS, AGGRAVATION BY BOMB & SHELL EXPLOSIONS SINCE SEPT 44 FRANCE
2 SGT 8/15 10-15 16.8 18.4 COACHING SMALL ARMS FIRING - 2 MOS 42 USA
3 PVT 12/15 10-15 22.4 24.0 HEAVY FIRING FA SINCE -3 JUL 43 USA
4 PFC 12/15 6/15 14.4 32.8 HEAVY FIRING 81 MM MORTAR - JUL 44 FRANCE

drop dosage as a possible nerve alterative during the time of hospital observation

To show the high tone loss sustained in acoustic trauma, there are depicted on one audiogram the findings in the first four patients with acoustic trauma examined subsequent to the original 310 (in which audiograms were not possible). If one peers at the grouping of symbols and numbers on the conglomerate audiogram, it will be noticed that the main drop occurs in the higher tones, especially around 2896 d.v. per second. The numbers 1, 2, 3, and 4, as they appear on the conglomerate audiogram, show the four audiometric curves obtained, with the dates the tests were made near the 128 column. It will be noted that there are numbers absent in the higher frequencies as these frequencies failed to be perceived. None of the four had pre-service or familial history of hearing impairment or ear involvement. The eustachian tubes, the ear drumheads, and the remainder of the conduction mechanism were considered to be within normal limits. None, except one who occasionally wore cotton in the ear canals, used protection in the ear canals or on the outside of the ears. All noted tinnitus subsequent to the more severe exposures.

Audiogram 1, of a private aged 20, who sustained this bilateral severe hearing defect following heavy firing of 75 mm. tank guns at

Fort Knox, Kentucky, January 1944, and overseas, with a bomb explosion August 28, 1944, and a shell explosion September 2, 1944, in France causing further involvement, shows a percentage decibel loss in the speech range of 48.8 on the right and 47.2 on the left. As he could hear whispered voice at only one foot in either ear (whispered voice heard at 15 feet being considered normal, although the Army Air Force uses 20 feet for residual air whispered voice as normal), it is obvious that he has lost most of his usable hearing. Immediate transfer to a center for the deaf was made as a percentage decibel loss of 30 or over in the speech range in the better ear permits entry to such a center for lip-reading instruction and appropriate rehabilitation in all its phases.

Audiogram 2 is that of a sergeant, aged 30, who developed his defective hearing after exposure to small arms firing, while coaching on a firing range at Camp Rucker, Alabama, for two months in 1942. In the speech range, the percentage decibel loss is only 16.8 on the right and 18.4 on the left, but throughout the recorded audiometric range, the percentage decibel loss is 31.6 and 28.8, respectively. This soldier did wear cotton in his ears occasionally during periods of exposure to firing.

Audiogram 3, of a private aged 27, who developed defection in hearing following exposure to heavy firing in the field artillery since July 3, 1943, shows the high tone loss, as in the other cases, most evident around 2896 d.v. per second.

Audiogram 4, of a private first class aged 35, who developed defective hearing following heavy firing of 81 mm. mortars in July 1944 in France, shows that the percentage decibel loss in the speech range for the right ear is 14.4 and for the left ear, 32.8. On the left, there are no other high tones heard after 2048 d.v. per second are heard at 40 db. of intensity.

As these four bilateral acoustic injuries occurred months previous to these examinations, it is considered that all losses will prove permanent.

A most fortunate fact is that if the frequencies in the speech range are minimally involved, the individual is seldom much concerned over his hearing impairment.

SUMMARY

1. The 310 cases of acoustic trauma which came to otologic consideration comprised only about 8 per 1000 of 21st General Hospital's admissions during the period January 1943 to July 1944.

2. Forty-two of the 310 patients were designated by Boards of Officers for evacuation to the Zone of Interior. Twenty-five of these, classified as being perception deaf, could hear, on an average, low conversational voice at a little over three feet in either ear.

3. Eighty-seven of the 310 were designated by Boards of Officers for permanent limited service duty. Thirty-four of these with bilateral nerve involvement had an average hearing of eight feet in either ear for low conversational voice.

4. One hundred eighty-one of the 310 returned to general service duty with an average bilateral loss in hearing of four feet for low conversational voice.

5. Ways of diminishing acoustic insult are discussed.

6. Four cases subsequent to the original 310 are represented on a conglomerate audiogram to show the high tone loss sustained in acoustic trauma with its usual initial depression around 2896 d.v. per second.

CONCLUSIONS

1. The least one should do is to wear cotton in the ear canals to diminish intense noise and explosion effect.

2. In training periods especially, routinely instituted precautionary measures would diminish acoustic trauma, so that at the front hearing acuity would be at its best.

3. The maximum improvement in hearing following acoustic trauma takes place in two months or less, and more readily in the younger individual. If no improvement takes place in that time, impairment is probably permanent.

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XLVI

CANCELLOUS BONE TRANSPLANTS FOR THE CORRECTION OF SADDLE NOSE

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The qualifications of an ideal nasal transplant are that the material be readily available in sufficient quantity and of a consistency that will permit of easy modeling. It must resist infection and absorption, be well tolerated by the tissues, and not subject to change in shape after implantation. While a graft meeting all of the above specifications is still a sought-for substance, we believe that at present cancellous bone obtained from the ilium is the material of choice. The superiority of this graft can best be demonstrated by comparing its qualities with those of some of the other substances which have been employed.

Of the alloplastic substances available for the building up of the nasal bridge, white vaselin was chosen by Gersuny in 1887;[1] in 1901 Eckstein introduced paraffin; and others later used these two materials in combination. While the immediate results of such injections were satisfactory, the subsequent inflammation, ulceration, abscess formation at the point of injection, and the later diffusion of the hydrocarbon into surrounding tissues, together with the danger of embolism and the secondary changes in the tissues, have condemned the use of all hydrocarbon compounds in surgery. Joseph[2] advocated the use of elephant ivory and for a time this substance enjoyed wide popularity. Foderl employed celluloid, and others have since report-

ed satisfactory results with gold, platinum, silver, aluminum, and amber. Since 1939 ticonium,[3] plexiglas[4] and vitallium[5] and many acrylic resins have been suggested. In 1940 Burch and Carney[6] introduced tantalum, a metal discovered by Ekeberg who named it tantalum because of his tantalizing experience with it. It is a metal, 73rd in the periodic table, bluish in color, ductile and malleable.

While alloplastic materials may give immediate satisfaction, can be obtained in any amount, molded to suit the particular need, can easily be sterilized, and procured without the necessity of mutilating other parts of the body, their use is fraught with danger. Like all foreign bodies, they are incapable of becoming incorporated as an integral part of the tissues and sooner or later, as a result of slight trauma, they are likely to become absorbed, undergo infection, or be extruded in the processes of inflammation and ulceration. In view of the present-day success with autoplastic material, there would seem to be little justification for the use of heteroplastic substances.

Soft tissue implants have also been experimented with and recommended on the grounds that they are more pliable and can be introduced piecemeal by means of a speculum through minute incisions. Of the soft tissue transplants, periosteum was first used by Reverdin,[7] muscle by Vighard, fascia by Koch,[8] dermal grafts by Rehn[9] and Eitner,[10] and bundles of catgut by Rueda. The greatest disadvantage of these materials lies in their tendency to undergo absorption.

Next to cancellous bone, cartilage is probably the most satisfactory material for grafts. It was first employed by Koenig to repair a loss of the larynx and trachea.[11] Subsequently von Mangoldt[12] used costal cartilage to furnish a nasal skeleton; and Nélaton and Ombrédanne[13] buried grafts of this material under the forehead skin for the same purpose. Cartilage has since found wide application in the building up of a great variety of defects.

Because cartilage is lymph-nourished and its metabolic processes are slow, it "takes" readily, retains its original morphology, and does not become absorbed or tend to shrink or disintegrate, even in the absence of perichondrium. While it is true that calcification and partial replacement by dense fibrous tissue may take place, nevertheless, these changes as a rule do not alter the architecture of the graft. The material is easily obtained in any amount and can be shaped without difficulty to conform to any desired pattern. It is well tolerated by the tissues. Loeb[14] found that the emplacement of autografts of cartilage in the tissues occasioned but little cellular reaction.

Pierce and O'Connor[15] have found that homogenous transplants of costal cartilage compare favorably with those of fresh material. They find these transplants superior to autografts in that they have less tendency to curl, heal more firmly, offer a greater resistance to infection, eliminate the necessity of painful operations on the chest, and reduce the time of hospitalization. At best, however, they are tolerated foreign bodies. Peer[16] recently found that "dead cartilage grafts buried from 9½ months to 2 years showed progressive invasion by fibrous tissue and partial absorption. In contrast to these findings autogenous rib cartilage grafts showed no invasion or absorption over the same period of time." In our experience of several hundred preserved cartilage grafts, we have found that these grafts have a tendency to produce a greater transient local reaction than those of autogenous origin.

Despite the advantages of cartilage, it has certain undesirable qualities not encountered in grafts of cancellous bone. It is prone to curl and its failure to form an organic union with the nasal bones, to which it becomes united only by means of fibrous tissue, frequently leads to an unnatural mobility.

Before discussing the advantages of the cancellous bone graft, perhaps it would be of benefit to review the present conflicting opinions in regard to bone grafting in general. The foundation for bone transplantation was laid by Ollier in 1867. Since then its therapeutic value has been amply demonstrated, and today it is an established surgical procedure. Its scope, however, would be considerably broadened if various basic problems concerning the process of osseous regeneration were solved. Among the many matters still in doubt are the ultimate fate of the transplant and the question of which, if any, of its various components plays the major role in osteogenesis. Obviously, the solution to these problems would be of the greatest assistance in the selection of the most appropriate type of graft.

The destiny of the transplant opens a debate which began with Duhamel[17] in 1757 and today still remains a subject of conflicting opinions.

There are those who hold the opinion of Ollier[18] that the entire graft survives, becomes revascularized, and grows as an integral part of the surrounding bone. The proponents of this concept reasonably maintain that the success or failure of a bone graft depends upon the rapidity with which the graft is able to establish an adequate blood supply. They point out that small bone grafts will "take" even without periosteum because of their easy vascularization, whereas large

grafts may, without periosteal assistance, undergo necrosis before a blood supply can be established.

Another school of thought, challenging the conclusions of Ollier, was originated by Barth,[19] who held that the bone graft becomes necrotic in all its parts and subsequently undergoes regeneration through osteoblastic infiltration from the neighboring bone, the graft itself serving merely in an osteoconductive capacity. This concept gained general acceptance, and for about ten years surgeons turned from the use of autogenous living bone grafts to the implantation of heterogenous bone.

Still others[20] take an intermediate stand and believe that part of the transplant is absorbed and that part survives and generates new bone. According to Trethowan,[21] when bone is transplanted under favorable conditions, the osteoblasts on its surface live and proliferate, while those in its deeper parts die. The living cells on the surface of the graft, assisted by osteoblasts from the neighboring bone, absorb the graft and at the same time lay down new bone ("creeping substitution"). Into the osteoporotic tissue new vessels and osteoblasts enter, and absorption and reformation take place in the depth of the graft.

While the presence of osteogenic properties in the bone graft is acknowledged by most physiologists, they are still faced with the unanswered question as to which of the component parts of the bone is responsible for osteogenesis. At present there are three schools of thought: Those who regard the periosteum and the endosteum as definite bone-forming organs, believing that osteoblasts arise from the cells of the periosteum and to a lesser degree from those of the endosteum. That the cells of the periosteum and the endosteum are the principal source of bone regeneration, the bone cells themselves playing little or no part, was first suggested by Goodwin; and this opinion has since been shared by Smye, Ollier, Axhausen, Lexer, Haas, Phemister, and others. Axhausen[22] and Lexer[23] believe that the bone itself dies but that the periosteum and the endosteum remain viable and assist in the regeneration of the transplant after the circulation is reestablished. Phemister[24] is of the opinion that the osteogenic properties reside in the inner layers of the periosteum, the endosteum, and to some extent in the bone cells and the fibrous contents of the haversian canals. Macewen[25] was the first to take issue with the conclusion that the periosteum possessed bone-forming properties, claiming that it served as a limiting membrane only and as a convenient source of blood supply. This view was later accepted by Gallie and Robertson, Cohn and Mann, Ghormley and Stück, and others.

Much of the controversy hinges on the question as to what actually constitutes the periosteum, and in this respect Horsley[26] states: "If the cambium layer on the cortex of the bone is included with the periosteum, it is undoubtedly true that this layer contains osteoblasts and will reproduce bone, but if this layer is not considered as a part of the periosteum proper, the periosteum then is only a limiting membrane."

A second school believe in osteal regeneration, that is, that bone is reformed from the bone cells liberated from the lacunae.

In recent years a new concept of osteogenesis has been suggested, founded on a biochemic, rather than on an anatomic, basis. The protagonists of this school assume that definite bone-producing cells do not exist; that bone regeneration is the result of an extracellular metaplasia of connective tissue cells striving toward a functional adaptation.[27] Two of the most enthusiastic advocates of this theory are Leriche and Policarde,[28] who state:

> "The formation of bone is the result of a metaplastic change in the connective fundamental substance. This metaplasia takes place in three ways: (1) Transformation of the connective tissue by an edematous infiltration with a multiplication of connective fibrils. (2) Infiltration by a special substance chemically undefined, the preosseous substance. (3) Deposits in that subtance of a calcareous mixture of calcium phosphate and calcium carbonate. Osseous metaplasia can occur in all types of connective tissue, embryonal type, fibrous type, etc."

Some surgeons favor osteoperiosteal transplants from the rib, the tibia or the crest of the ilium and osteochondral transplants from the rib. They are especially applicable for the reconstruction of saddle noses in children, since, unlike cartilage, they form an osseous union with the remaining nasal bones and grow with them. Generally speaking, however, the "take" is not as certain as in cancellous bone grafts, since in compact bone vascularization cannot take place until the salts are absorbed, and this delay predisposes to loss of the graft.

In saddle nose deformities it has been our experience that cancellous bone obtained from the ilium is an unrivaled grafting material which most nearly meets the requirements of an ideal transplant. The spongy character of the bone renders it adaptable for the penetration of tissue fluids and tissue cells from the host, as a result of which there is a greater assurance of vascularization and a relatively short period of organization—all of which enhance the ultimate "take." The material is readily available in any amount and the operative procedure for procuring the graft is a relatively simple one and leaves no residual disability. It is of such a consistency as to permit of easy modeling. It resists infection and absorption and is so

well tolerated by the tissues that it will "take" under conditions which contraindicate the use of other grafts; for instance, we do not hesitate to narrow the nasal pyramid, clear the airways by reconstructing the septum, and supplement these procedures by the introduction of a cancellous bone graft. Unlike cartilage, it is not subject to change in shape after implantation.

Preoperative Considerations. Inasmuch as the graft must receive its nutrition from the adjacent tissues, various preliminary measures must be carried out to insure its success.[29]

Scars over the nose must be made soft and pliable by massage. When they are so extensive as possibly to interfere with vascularization of the graft, they should be removed and replaced either by a skin graft or a flap—the choice depending on the depth of the scar tissue. If the tissues were previously infected, sufficient time must have elapsed to insure against the possibility of recurrence. If the nasal pyramid is deflected or too broad or if the septum is distorted, these structures must be first corrected.

To insure precision in the shaping of the transplant and lessen the danger of infection by repeated trial insertions, a cast is made (Fig. 1). On this cast the scapha is built up in stent to the normal contour and the model is sterilized with the instruments at the time of operation. If the tip of the nose as well as the dorsum requires support and it becomes necessary to insert a columellar strut, the distance from the glabella to the proposed tip and from there to the anterior maxillary spine is also calculated on the cast, so that the strut may be cut according to measurement.

OPERATIVE TECHNIC

1. *Preparation of the Bed for Reception of the Transplant.* The first step of the operation is the preparation of the bed which is to receive the transplant. The nose and surrounding parts are cleansed and draped and the parts anesthetized. For the insertion of the dorsal graft a circumferential incision is made in the left vestibule along the lower margin of the lower lateral cartilage (Fig. 2). The incision should be of such size as to admit the graft easily. A Stevens tenotomy scissors is introduced between the lower lateral cartilages and the overlying structures in the plane immediately overlying the perichondrium and the soft structures elevated (Fig. 3). Then a blunt, double-edged curved knife is introduced and the soft tissues are separated from the dorsum (Fig. 4). The knife should be kept as close to the periosteum as possible so that a thick layer of skin and

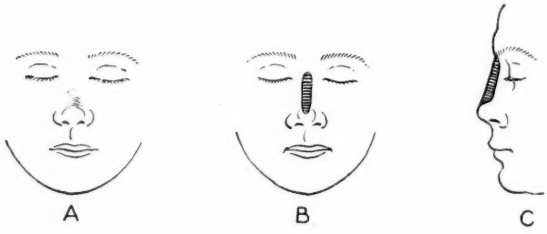

FIG. 1

FIG. 2

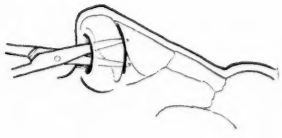

FIG. 3

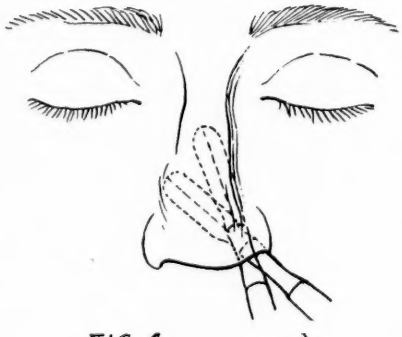

FIG. 4

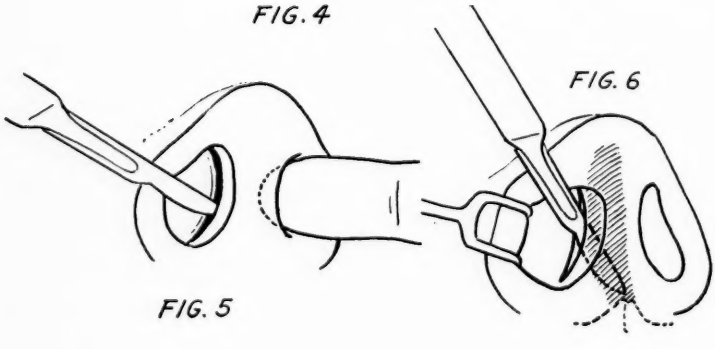

FIG. 5

FIG. 6

Fig. 1.—Pattern of proposed graft. *A*—Cast of face showing deformity. *B*—Saddle built up in stent. *C*—Profile view.

Fig. 2.—Circumferential incision along caudal margin of lower lateral cartilage.

Fig. 3.—Overlying structures separated in plane immediately above perichondrium.

Fig. 4.—Separation of soft structure continued over dorsum with blunt, curved, double-edged knife.

Fig. 5.—Membranous septum incised for introduction of columellar strut.

Fig. 6.—Bed prepared in columella for reception of graft.

subcutaneous tissue will be provided over the transplant. This promotes firm adhesions between the under surface of the graft and its bed, and the thick layer of skin and subcutaneous tissue above it not only enhances the nutrition but conceals the outline of the graft. At the upper end of the bed, in the region of the frontonasal angle, the periosteum is undermined for the reception and immobilization of the tapered end of the proposed transplant. At the lower end of the bed the plane of dissection should be made close to the lower lateral cartilages; otherwise, the subsequent contraction of the soft tissues may cause traction on the graft and result in a distortion of the nasal tip. The dissection should be accomplished with the greatest gentleness, as even slight trauma may interfere with vascularization.

The pocket to receive the graft should be of a size that will exactly accomodate the transplant. If it is too small, the tension produced after the introduction of the graft will interfere with the nutrition of the overlying skin; conversely, if it is too large, the transplant will have a tendency to slip out of position. In depressions involving but one-third to one-half of the dorsal length a better nasal contour and more satisfactory immobilization of the graft will result from shaving the entire dorsum down to an even plane and filling the scapha with a single long graft extending from the glabella to the tip of the nose, than from filling the original cavity with a small graft.

To introduce a columellar strut, an incision is made along one side of the membranous septum from the caudal end of the septum to the nasal spine (Fig. 5). Through this incision a bed is made in the columella between the two mesial crura (Fig. 6).

After the bed has been prepared, bleeding is controlled by gentle pressure over the dorsum with a pad of gauze wrung out of hot physiologic sodium chloride solution. The surgeon and personnel then effect a change of raiment, freshly sterilized instruments are supplied to prevent cross-contamination, and the transplant is secured. To shorten the time of operation, it is advisable that the graft be removed by a second surgical team while the bed is being prepared.

2. *Obtaining the Graft.* The hip is prepared and draped, and a sandbag is placed under the patient's side to make the part more accessible. Several wheals are raised over the crest of the ilium from the ventral to the dorsal extremity of the proposed incision. Through each of these a 2-inch needle is thrust until its point abuts the surface of the bone. Here 1-2 cc. of a one per cent solution of procain-epinephrin is injected. The process is repeated until the entire area to

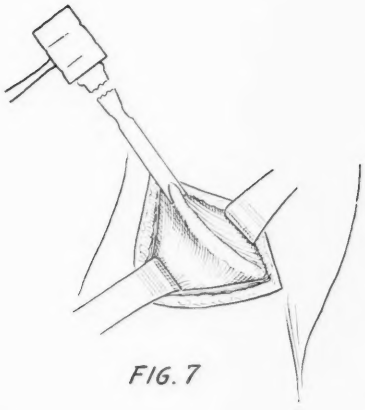

FIG. 7

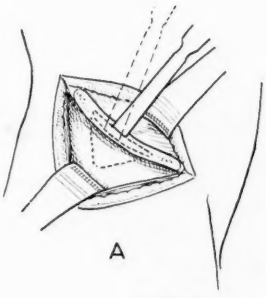

FIG. 8

FIG. 9

Fig. 7.—Periosteum and thin layer of cortex of bone resected with chisel and mallet.

Fig. 8.—Cancellous bone graft removed with chisel. *A*—Graft outlined in oblique manner. *B*—Sagittal section showing course of chisel cuts.

Fig. 9.—Modeling of graft.

be operated on is infiltrated. Thirty cc. of the solution are usually sufficient to secure the desired anesthesia.

An arched incision, convex side down, is made through the skin beginning at the anterior superior spine and extending dorsally along the crest as far as necessary to secure a graft of sufficient size. The purpose of a curved incision is that, when the soft tissues are sutured back into place, the suture line will not lie directly over the area from which the graft was removed. Towels are adjusted to the wound edges with towel clips and the incision is deepened to the bone. The soft tissues are retracted and the gluteus muscle is stripped from the bone until a suitable area is exposed. Hemorrhage is slight and can usually be controlled by pressure.

An area somewhat larger than the proposed graft is then outlined by an incision through the periosteum, and the periosteum together with the cortex is resected with a chisel and mallet (Fig. 7). A piece of cancellous bone of the appropriate size is then removed as follows:

To prevent splintering, the graft is undercut with a thin, broad chisel, first on one side and then on the other, in an oblique manner so that the cuts will meet beneath the center of the graft at the required depth (Fig. 8). No attempt should be made to elevate the graft until it lies free in its bed. While a motor-driven saw will cut through the bone in a much shorter time, we have abandoned its use in the belief that the heat engendered, despite a constant flow of sodium chloride solution, tends to impair the viability of the bone. The graft when removed presents a rich, dark red color and shows blood oozing from multiple small points.

Following the removal of the graft the assistant checks the bleeding, sutures the detached muscles back in place with a few catgut sutures, approximates the skin margins, and inserts a Penrose drain, to be removed in 24 to 48 hours. A pressure dressing is then applied. Meanwhile, the surgeon models the graft.

3. *Modeling the Graft.* The fragment of cancellous bone having been removed, it is placed on a special side table with edges elevated as a precaution against accidental slipping during the process of trimming. It is manipulated with bone forceps rather than with the fingers, lest the spicules of bone perforate the glove, with the danger of contamination. Modeling is done with bone-biting forceps and files of various shapes (Fig. 9).

The graft is shaped in accordance with the pattern made on the cast (Fig. 1). The outer surface is so trimmed as to carry the dor-

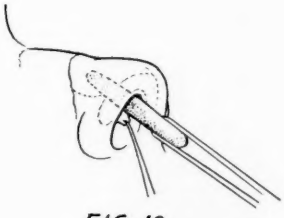

FIG. 10

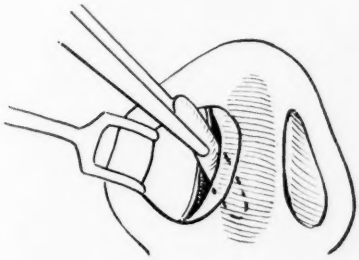

FIG. 11

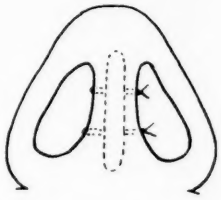

FIG. 12

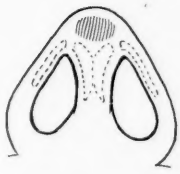

FIG. 13

Fig. 10.—Introduction of graft. Flap of lower lateral cartilage drawn down with hook and modeled transplant inserted.

Fig. 11.—Insertion of columellar graft into prepared pocket.

Fig. 12.—Graft held in place by two silk sutures passed behind it.

Fig. 13.—"Button" of cancellous bone introduced beneath skin of lobule to increase projection of tip beyond level of dorsum.

sum in an uninterrupted line from the frontonasal angle to the nasal tip. The sides are fashioned to merge with the lateral walls of the nose. The under surface is modeled to fit snugly into the bed which is to receive it, and bevelled to permit of maximum surface contact. The upper end is tapered to a thickness of 1-2 mm., so that it will fit easily into the periosteal pocket previously made at the nasal root. The lower end is also tapered to blend with the tip. All irregularities are filed down and the corners are rounded to prevent irritation of the soft tissues which will ultimately surround it. Any small particles of bone which collect on the graft during the modeling process are lifted off with forceps and not wiped off with gauze or

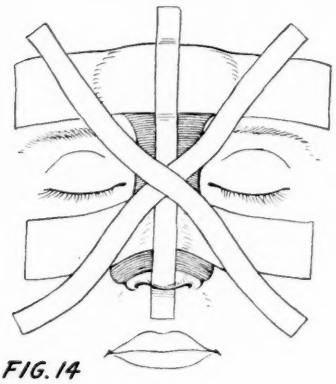

Fig. 14.—Dressing. Flannel-lined stent molded to reconstructed nose and held in place with adhesive strips.

cotton sponges, as small fibrils from the latter material may adhere and act as foreign bodies.

4. *Insertion of the Graft.* The shaped dorsal transplant is grasped with a toothed forceps and inserted into its bed through the initial incision, the margins of which are widely retracted to prevent the graft from becoming contaminated by contact with the skin edges (Fig. 10). Its upper end is slipped into the periosteal pocket previously prepared at the nasal root. If the graft is correctly modeled and its bed properly prepared, it will lock easily into place and immediately obliterate the deformity. If further positioning is necessary, it can easily be accomplished by external manipulation. Any blanching of the skin over the graft indicates too great tension upon the surrounding soft parts, and under such circumstances the graft must either be removed and made smaller, or the soft tissues must be undercut sufficiently to assure tensionless reception of the transplant.

If a columellar strut is to be used, the bed previously made between the mesial crura is exposed with dural hooks and the strut inserted (Figs. 5, 6 and 11). It is so placed that one end abuts the anterior maxillary spine and the other falls short of the angles of the lower lateral cartilages. The graft is anchored in place by one or two silk mattress sutures passed through the vestibular skin behind the

graft (Fig. 12). The membrane incision is closed with atraumatic sutures.

Inasmuch as the tip of the nose should project 1-2 mm. beyond the level of the dorsum, the contour can usually be enhanced by slipping a small "button" of cancellous tissue beneath the skin at this point (Fig. 13).

The nose is loosely packed with half-inch strips of vaseline gauze. The grafts are held in position externally by narrow strips of adhesive tape applied around the tip and over the bony dorsum. To protect the nose against trauma and minimize postoperative edema, a stent dressing is firmly applied and held in place with adhesive strips (Fig. 14).

COMMENT

Cancellous bone for grafting purposes has long been used in orthopedic surgery. Henderson writes:

> "The scrapings [cancellous bone] that are saved to be packed around the site of fracture and along the margins of contact of the bone graft with the fragments, near the line of fracture, furnish great physiologic stimulation and help in causing the fragments and graft to unite rapidly. This insures a large amount of spongy bone near the fractured ends, which are sluggish physiologically and need this stimulation."

The use of this material, however, for the correction of saddle nose has to our knowledge never been reported.

While our first graft was introduced but three years ago and we realize that this is too short a period to predict the ultimate fate of such transplants, nevertheless, we have found this graft so far superior to those of other materials that we believe it warrants recording.

In the near future we contemplate experimenting with cancellous bone prepared in the form of a mash which we shall attempt to introduce by means of a speculum through a small intranasal incision and to mold into the desired contour by external manipulation.

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REFERENCES

1. Gersuny, R.: Kleinere Mittheilungen Plastischer Ersatz der Wangenschleimhaut, Antralbl. f. Chir. 14:706, 1887.

2. Joseph, J.: Nasenplastik und Sonstige Gesichtsplastik, Leipzig, C. Kahtzck, 1931.

3. Camphill, E. H., Meirowsky, A., and Tompkins, V.: Experiments on the Use of Ticonium in Cranial Repair, Ann. Surg. 116:763-775, 1942.

4. Gurduian, E. W., Webster, J., and Brown, J. C.: Impression Technique for Reconstruction of Large Defects, Surgery 14:876-581, 1943.

5. Beck, C. S.: Repair of Defects by Ready Made Vitallium Plates, J. A. M. A. 118:798-799, 1942.

6. Carney, H. M., and Burch, J. C.: Experimental Study with Tantalum, Proc. Soc. Exper. Biol. and Med. 51:147-148, 1942.

7. Reverdin, A.: Greffes de perioste de lapin sur une jeune fille, dans un cas de rhinoplastie partielle, Cong. internat. d. sci. med., (ses. 6) p. 430, 1879.

8. Koch, F.: Neure Methoden und Fragen der Nasenplastik, Berl. klin. Wchnschr. 50:1612, 1913.

9. Rehn: Referred to in: Post-Graduate Surgery, New York, D. Appleton-Century Co., 1937.

10. Eitner, E.: Ueber Unterpolsterung der Gesichtshaut, Med. Klin. 16:93, 1920.

11. Koenig, F.: Ueber Reaktive Vorgaenge am Knörpel nach Verschiedenen Schaedigungen, Arch. f. klin. Chir. 124:1, 1923.

12. von Mangoldt, F.: See: Kirschner, M., Allgemeine und Spezielle Chir. Operations-lehre, Berlin, J. Springer, 1935.

13. Nélaton, C., and Ombredanne, L.: La Rhinoplastie, Paris, G. Steinhill, 1904.

14. Loeb, L.: Transplantation and Individuality, Physiol. Rev. 10:547, 1930.

15. Pierce, G. W., and O'Connor, G. B.: Reconstructive Surgery of the Nose, Annals of Otology, Rhinology and Laryngology 47:437, 1938.

16. Peer, L. A.: Cartilage Transplanted Beneath the Skin of the Chest in Man, Arch. Otolaryn. 27:42, 1938.

17. Duhamel du Monceau, H. L.: On the Formation of Bones in Animals and of Wood in Trees, Rec. period d'obs. de med., de chir. et pharm. 7:161, 1757.

18. Ollier, L.: Recherches experimentales sur la production artificielle des os et sur la regeneration des os, J. de la physiol. de l'homme 2:1, 1859.

19. Barth, A.: Ueber Histologische Befunde nach Knochenimplantationen, Arch. f. klin. Chir. 46:409, 1893.

20. Frankenstein, H.: Ueber Freie Knochentransplantation zur Deckung von Defekten Langer Rohrenknochen, Beitr. z. klin. Chir. 64:121, 1909.

21. Trethowan, W. H.: A Note on his Technique of Bone-Grafting by Lambrimedi and Stamm, Guys Hosp. Rep. 87:469, 1937.

22. Axhausen, G.: Die Histologischen und Klinischen Gesetze der Freien Osteoplastik auf Grund von Thierversuchen, Arch. f. klin. Chir. 88:23, 1909.

23. Lexer, E.: Zwanzig Jahre Transplantationsforschung in der Chirurgie, Arch. f. klin. Chir. 138:251, 1925.

24. Phemister, D. B.: The Fate of Transplanted Bone and Regenerative Power of Its Various Constituents, Surg. Gynec. & Obst. 19:303, 1914.

25. Macewen, W.: Growth of Bone, Glasgow, J. Maclehose & Sons, 1912.

26. Horsley, J. S., and Bigger, I. A.: Operative Surgery, St. Louis, C. V. Mosby Co., 1937.

27. Leriche, R., and Policarde, A.: Normal and Pathological Physiology of Bone, St. Louis, C. V. Mosby Co., 1928.

28. Leriche, R., and Policarde, A.: Le perioste et son rôle dans la formation de l'os, Presse méd. 26:143, 1918.

29. Fomon, Samuel: The Surgery of Injury and Plastic Repair, Baltimore, Williams & Wilkins, 1939.

30. Henderson, M. S.: The Massive Bone Graft in Ununited Fractures, J. A. M. A. 107:1104, 1936.

XLVII

THE MANAGEMENT OF FRACTURES OF THE NASAL BONY VAULT

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The rhinologist who is experienced in reconstructive nasal surgery is aware of two important facts: that millimeter variations affect great cosmetic changes and that bone fragments of the nose may be manipulated and adjusted easily. These facts have significant application in the management of the fractured nose.

The unlocked fragments of bone, the displaced spicules or the overriding bone edges, which are considered to be negligible at the time of manipulation, eventually prove to be the basis of marked deformities and produce a thickened, twisted, indented or flattened nose. Thus the deformities may not be manifest until the edema secondary to the injury has subsided.

The bony elements of the nose, when loosened, despite radical alterations as in rhinoplasty, stay as they are fitted together because: the muscular pull on them is negligible; the bones serve only as contour supports; and they are thin, flat bones sandwiched between two adhesive layers—the mucoperiosteum internally and the periosteum and skin externally. The first of these factors was recently discussed in detail by Greismann,[5] who pointed out that there are only two weak muscle slips attached to the nasal framework: the compressor narium and the processus angularis of the quadratus labii superioris. The second factor is self-evident. The third factor is not generally appreciated and is of great importance. Thus most mechanical supports for the nose have been designed on the premise that the bone fragments act in vivo as they do in a dried skull. The presence of the adhesive coverings is ignored and it is presumed by many that when the nasal arch is shattered, support is required to maintain the fragments in proper relationship after reduction. In the presence of a fracture these coverings serve a definite function which when appreciated and utilized simplifies management.

The bony framework of the nose consists of the arched, thin, flat, rhomboid-shaped nasal bones whose thickened upper ends are firmly

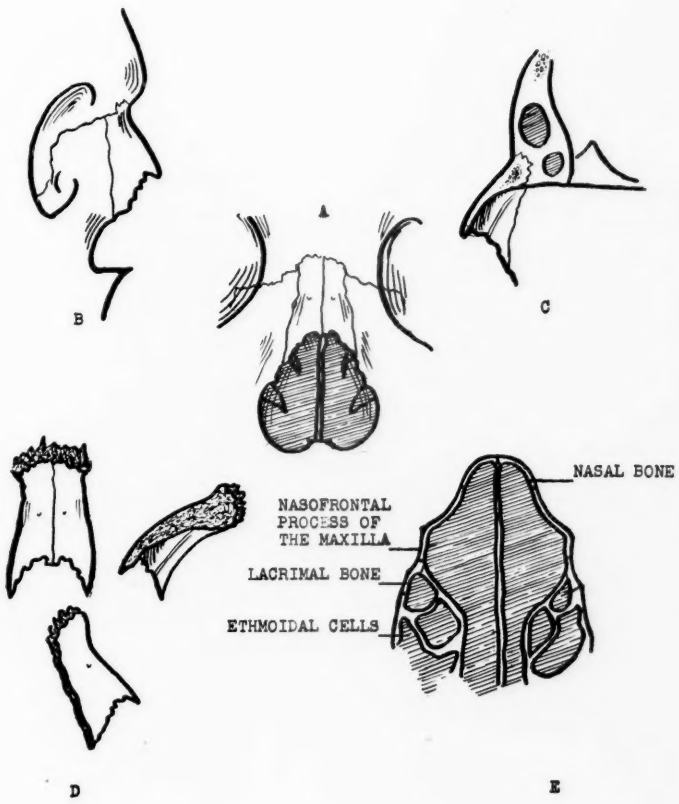

Fig. 1.—A. Frontal view of the nasal bony arch; B. Lateral view of the nasal bony arch; C. Saggital section of the nasal bony arch; D. Disarticulated nasal bones; E. Horizontal cross section of the nasal bony arch.

set and locked against the nasal processes of the frontal bones (Fig. 1 B, C and D). Abutting upon the lateral aspects of these are the thin and brittle nasofrontal processes of the maxillae (Fig. 1 A and E). The very thin perpendicular plate of the ethmoid is set under the bony arch like a ridge pole (Fig. 1E). That this plate has no actual supportive function as far as the bony arch of the nose is concerned is attested in the living subject by the many times that it is removed in the course of a submucous resection of the septum and by its frequent crumbling in dried skull preparations without any effect on the arch. As noted in Fig. 1D, the nasal bones are narrowed from side to side superiorly, but are thickened anteroposteriorly. Because of their shape and the firm locking between the nasal processes of the frontal bones, the nasal bones fracture most readily in their distal two-thirds. The nasofrontal processes of the maxillae also fracture easily because of their thinness.

Experiment. A replica of the nasal arch was prepared in scale of dental modeling compound. The surfaces were then covered with adhesive tape. This then represented the nasal bony arch in vivo, an arch of thin bones sandwiched between two adherent layers (Fig. 2A). When this arch was cracked and misshapened, the deformity could be corrected by realigning the fragments (Fig. 2B and C). The arch was found to maintain its proper shape because the adherence of the fragments to the covering or the lining, or both, kept them in place and permitted them to be fitted into position. This was found to be true even in the face of extreme comminution (Fig. 2D and E).

In the living subject, the periosteal attachments to the bone are so firm that it is rare for the fragments of a comminuted bone to be stripped of both layers. Thus with the fragments of a shattered arch attached to one layer or the other, the fragments may be manipulated and fitted back into their respective places in the arch. There is no tendency for the deformity to recur and the restored arch maintains itself without mechanical support. Its failure to do this may be traced to incorrect alignment.

If this concept is correct, nasal fractures of all types may be reduced and normal relationships obtained simply. The restored arch needs only protection while healing occurs. This protection may be furnished externally by a molded splint and internally by packing or a Simpson's splint. Metzenbaum,[9] in discussing a case of basilar fractures of the nose, applied this idea and referred to it as an orthopedic method. Fomon,[3] in his discussion of recent nasal fractures, implies that the technique of management is all important. Neither author pointed out the basis for the success of their methods nor

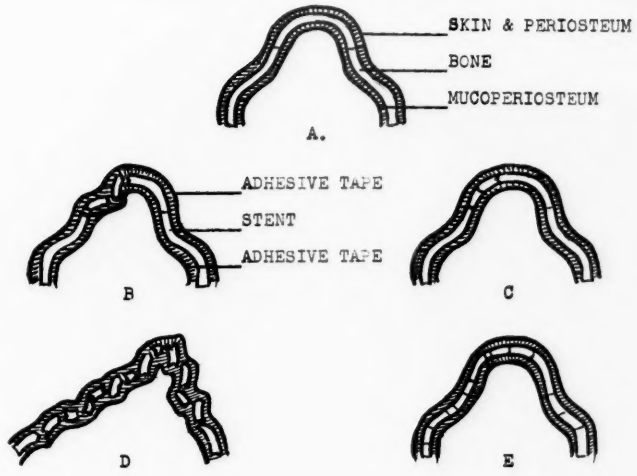

Fig. 2.—A. The nasal bony vault and its coverings compared to the model B prepared from stent and adhesive tape. B. One side of the model vault has been broken. C. The fragments have been realigned and maintain their relative positions because of their attachment to both the covering and the lining. D. Comminution of the model arch. E. The fragments have been realigned and the arch reformed. Stretching of the soft tissues facilitates fitting the fragments together.

that their application would permit the simple management of even severe fractures.

The fact that so many types of appliances have been designed suggests that none of them have proved to be completely satisfactory, nor that they are the answer to the question of how to obtain better results. This, I believe, is the result of the cursory manner in which the technique of fracture management is regarded as well as the failure to appreciate and apply the factors noted above. This subject is dispensed with in the various textbooks and articles by directions as nonspecific as: "the method of fracture is reversed"[10] or "a blunt instrument is inserted into the vault and the fragments are elevated as the nose is molded externally with the fingers."[14] Straith and DeKleine[13] suggest that in simple nasal fracture, the fragments should be elevated and overcorrected to prevent recurrences. Overcorrection of such thin bones so prominently located, however, merely means

substituting one type of deformity for another. In an effort to overcome the deficiencies of such instructions varied instruments have been designed.[2, 6, 7, 12, 15, 17, 18] Other methods of support have been suggested such as through-and-through sutures,[8] wire ligatures,[12] and guy wires anchored to the teeth.[1] The objections to these devices are their cumbersomeness, their discomfort to the patient, their cost, their impracticability in the usual armed force installation, and the reliance placed upon them for proper correction of the deformity instead of upon the actual manipulation. No attention has been directed to the importance of proper reduction or the details of manipulation.

The success of any manipulation rests completely on proper interpretation of the deformity presented. Visualization of the anatomy of the fracture depends upon a clear concept of the normal anatomy and an understanding of the mechanics of nasal fracture. This latter subject has been discussed adequately many times[4, 11, 16] and it will not be elaborated upon here.

The roentgenogram frequently is of great assistance in determining the nature of a fracture by its demonstration of the location of the fragments and the presence of fracture lines. When the displacement is slight and the edema is great, the existence of the fracture may be demonstrated only by the roentgenogram. However, it is of little help in visualizing properly the fracture anatomy when there is much overriding and superimposition of fragments.

During a two-year period, 130 nasal fractures of all types have been cared for in the Camp Stoneman Station Hospital. These patients applied for treatment from a few minutes to three weeks after injury. Because the normal nasal cavity is bacteriologically clean, only those cases in which there were skin lacerations over the fracture sites were classified as compound fractures (although properly those with mucosal lacerations are also compound). Twenty-five per cent of the fractures were compound. Twenty per cent of the fractures were comminuted. The fractures were separated into two main types—the depressions and the lateral displacements. This is a loose classification but it has proved to be practical and it has adopted itself easily to anatomical descriptions. Forty per cent of the fractures were depressions and 60 per cent were lateral displacements. Only 10 per cent of the cases had periorbital subcutaneous emphysema (a condition which never was treated specifically other than to instruct the patient not to blow his nose). No treated patient in this series was encountered who had a cerebrospinal fluid leak; that is, no such patient survived to have his nasal fracture treated.

In order to best explain the technique of management, specific cases of the different types have been selected and described. It is to be noted that in each instance the external molded splint of dental modeling compound was used for protective purposes only. Similarly, Simpson's splints and occasionally vaseline gauze were used inside the nose only to prevent dislodgement in the event of undue pressure during the sleeping or waking hours. The internal supports were in most instances removed within 24 hours' time because the marked edema of the mucous membrane acted as an adequate splint internally after this time. All the cases were treated under local anesthesia with ten per cent cocaine. In very severe cases this was supplemented with block anesthesia of the nerves of the external nose with one per cent procaine. The technique for this anesthetization varied with the dictates of the particular case. Sulfanilamide powder was dusted into the lacerations and in severe cases one of the sulfonamide derivatives was administered orally as a prophylactic measure.

The most useful instruments for the manipulation were the Asch forceps and, as an elevator, a narrow Lagenbeck periosteal elevator. The blades of the Asch forceps were covered with thin latex rubber tubing of the type used with blood pipettes. This protected the soft tissues adequately without adding materially to the diameter of the forceps. The elevator served as an ideal instrument because its handle is adequate for firm gripping and the slight finger-like curve of the end permits enough purchase to be obtained on the fragments to facilitate their manipulation and alignment. The end of this elevator was also covered with latex rubber tubing.

REPORT OF CASES

Direct Depressions

CASE 1. Depression of the Nasal Bones. J. E. B., December 12, 1943. A 20-year-old soldier presented himself with the complaint of having been struck on the nose by a bottle the night before.

On inspection there was a humplike swelling of the nasal dorsum. Palpation revealed a depression under the edema. The septum was buckled to the right and there was a slit in the septal mucoperichondrium with a free edge of cartilage projecting through it. A roentgenogram showed a depression fracture of the lower half of the nasal bones with their distal ends tilted anteriorly.

Reduction was accomplished by elevating the upper ends of the fragments with a rubber covered elevator as digital pressure was ap-

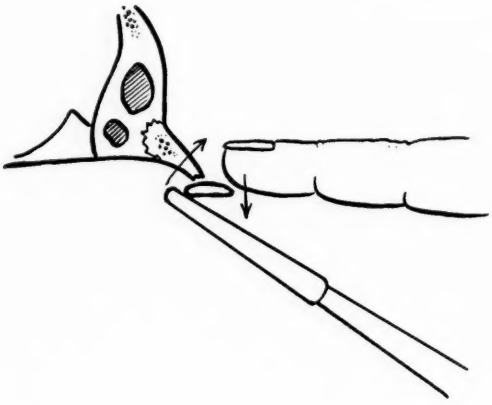

Fig. 3. Case 1.

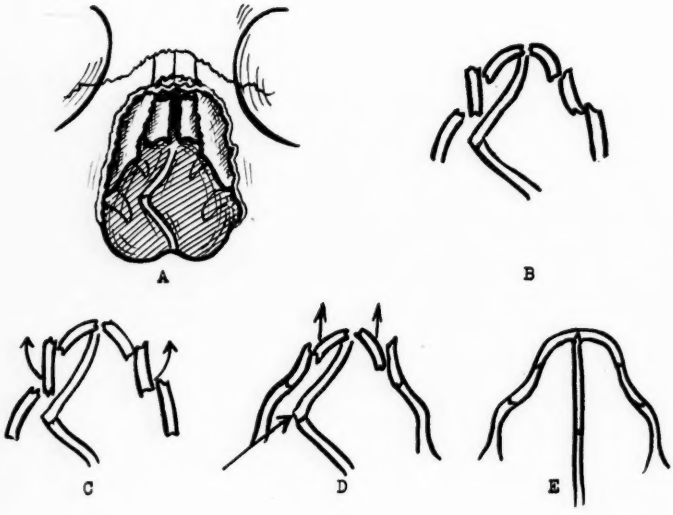

Fig. 4. Case 2.

plied to the distal ends (Fig. 3). The septal dislocation was overcome by pressure against the convexity and realignment with an Asch forceps. Vaseline gauze packing was used on each side of the septum. The packing was removed in 24 hours. There was no tendency to recurrence of the deformity.

CASE 2. Depression of the Nasal Bones and the Nasofrontal Processes of the Maxillae. J. E. R.; March 9, 1943. Two hours before treatment this 27-year-old soldier was struck on the nose by a fist.

The nose was flattened and widened. Palpation revealed firm sharp edges on each side of the nose in a line just medial to the inner canthi of the eyes. Along each side of the depressed dorsum slight ridges were also felt. The septum was buckled to the right and there were linear tears in the mucosa on the right side of the septum and on the lateral wall from the rima pyriformis to the anterior end of the lower turbinate. Roentgenograms showed a transverse fracture through the center of the nasal bone with depression of the fragments. In addition there were longitudinal fractures through each nasofrontal process. These findings were interpreted to represent a depression fracture of the nasal bones with the fragments underriding the nasofrontal processes which in turn were cracked off (Fig. 4).

Reduction was accomplished by first grasping the nasofrontal process on one side with a rubber covered Asch forceps and gently rotating its lateral edge outward over the opposing edge of the maxilla (Fig. 4C); then the rotation was reversed to raise the medial edge of the fragment. The same procedure was followed on the other side; then the depressed nasal bones were elevated to fit like a keystone between the lateral fragments (Fig. 4D). The septal buckling was overcome by pressure with the Asch forceps. Simpson splints were inserted along the dorsum of the nose bilaterally and a molded stent splint was applied externally. The internal splints were removed in 24 hours but the stent was used for ten days.

As may be noted in the cross sectional views in Fig. 4, indiscriminate elevation without heed to the overriding in this case would result in spicules being broken off the overlapping bone edges and these, if not set into proper place, would cause a widening of the nose as well as a flattening. The application of "orthopedic" technique avoids these changes and permits the nasal arch to be set back into its proper position.

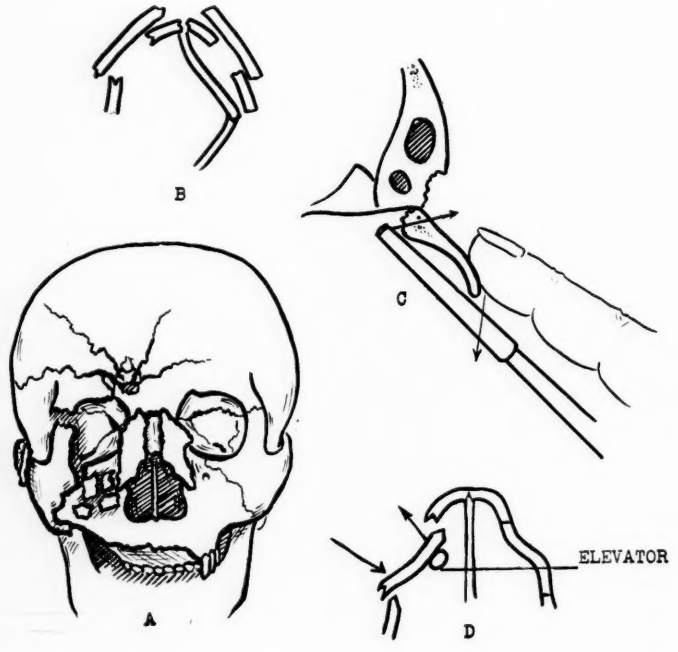

Fig. 5. Case 3.

CASE 3. Depression of the Nasal Bones with Fracture of the Frontal Bone and of the Maxillae. Mrs. H. C.; April 9, 1943. A 32-year-old, white female sustained a series of "dashboard" fractures while riding in an automobile that was involved in an accident.

Examination and roentgenograms revealed the following injuries: a stellate fracture of the frontal plate, a compound fracture into the right frontal sinus with avulsion of the right trochlear pulley, a depression fracture of the right zygomatic bone, comminution of the anterior wall of the right maxilla, fracture of the maxillary alveolar process from the third left tooth to the eighth right tooth, and complete comminution and depression of the nasal framework (Fig. 5A). The depression of the nasal dorsum was so complete that there was little ridge intervening between the inner canthi of the eyes. The fragments of the lateral edge of the nasofrontal process had been forced over the edges from which they had been broken, and this gave the impression of a marked lateral spread.

The patient was first treated for shock. When her shock symptoms had subsided 20 hours after the accident, all the fractures were reduced under a local anesthesia. Since we are here concerned with the nasal fracture only this will be described in detail. As noted in Fig. 5C the nasal bones were broken off in one fragment and telescoped backwards and upwards. The nasofrontal processes were thrust laterally. The septum was buckled and there was a linear tear extending backwards parallel to the floor across the septal cartilage about 3/4 inch above the floor. There were lacerations just beyond the vestibule on each side that followed the rima vestibulari.

Because the nasal bones were broken off in one piece and were thrust upward and backward below the nasofrontal process of the maxilla and under the nasal processes of the frontal bones, a rubber covered elevator was placed under them, and as the elevator pushed the fragment anteriorly, a finger placed on the outside of the nose, forced the fragment caudally (Fig. 5C). The resultant vector force permitted the narrow upper ends of the bones to be unlocked and set into their seat against the nasal process of the frontal bones. The medial edge of one nasofrontal process was then elevated as the lateral edge was forced by finger pressure medially and posteriorly (Fig. 5D). This caused the fragment to slip into its proper relationship as a supporting arm to the nasal arch. This was repeated on the opposite side. The upper portion of the septum was grasped with the Asch forceps and thrust upwards until the buckling was relieved and the septal edges brought into abutment. Simpson splints and molded stent splints were used in this case also.

In a case of this type, where there was such extensive damage and where the cosmetic end-result was so vitally important, careful judgment was demanded. The temptation to resort to the use of the various mechanical supports or through-and-through wire sutures, which are recommended, was great. The laceration which opened into the frontal sinus prompted the suggestion that it permitted easy access for wiring the nasal bones to the nasal processes of the frontal bone. It was found, however, that when the conservative method described was used, the contours were restored and were maintained without support. The Simpson splints were removed in 24 hours. The molded stent splint was used for ten days. Healing was uneventful and the cosmetic result was excellent.

Lateral Depressions.

CASE 4. Depression of the Nasofrontal Process of the Maxilla only. R. L. J.; May 4, 1944. Fifteen minutes before examination

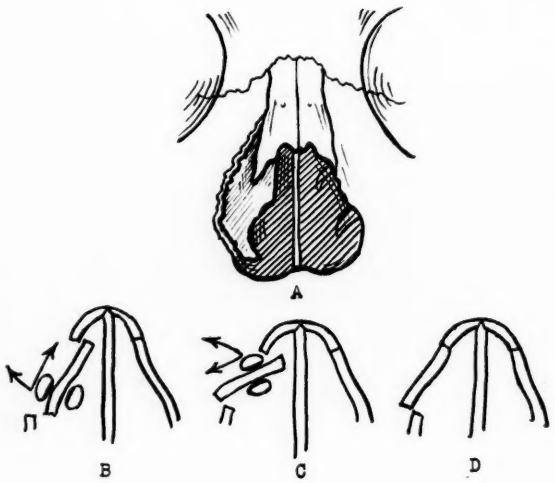

Fig. 6. Case 4

this 20-year-old soldier had been kicked in the nose by a boot heel while wrestling.

There was neither swelling, abrasion, nor discoloration but there was marked depression of the right side of the nose. The sharp edges of bone could be palpated and on intranasal examination, the right rima pyriformis was seen to be approximated to the nasal septum. The fragment broken off appeared to be about one inch by one-half inch. (Fig. 6).

The lateral end of the fragment was grasped by Asch forceps and then thrust anteriorly until the end could be easily lifted over the maxillary edge from which it had been cracked (Fig. 6B). The forceps were then shifted to the medial end and the fragment was thrust posteriorly until the medial end could be set against the nasal bone (Fig. 6 C and D). The lateral end slipped easily into place then where it wedged firmly.

CASE 5. Depression of the Nasofrontal Process and Medial Portion of the Infraorbital Rim of the Maxilla. H. B.; January 21, 1944. A 30-year-old soldier was struck by a fist on the right side of the face with resultant extensive nasal hemorrhage and great pain below the right eye.

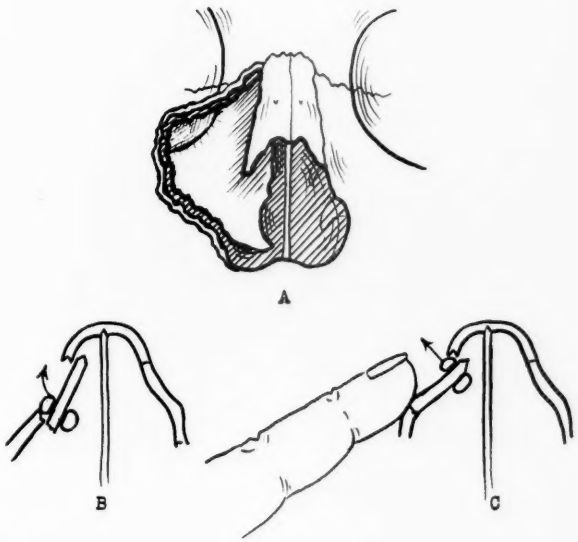

Fig. 7. Case 5

On inspection it was noted that the usual graceful slope of the lateral nasal wall was replaced by an acute angulation. A sharp edge extending from the infraorbital foramen to the rima pyriformis could be palpated. The portion of the infraorbital rim medial to the foramen was deficient. Another sharp edge was felt at the edge of the right nasal bone and intranasal inspection revealed a rent in the mucoperiosteum through which the medial edge of the nasofrontal fragment protruded. The patient had definite right infraorbital anesthesia. Fig. 7 illustrates the nature of the fracture.

The nasofrontal process was grasped by an Asch forceps near its outer edge and then it was twisted clockwise to raise the lateral edge over the edge of the maxilla. Then, as this lateral edge was held firmly with finger pressure, the forceps were shifted, the twist was reversed and the medial edge of the fragment was raised into approximation with the nasal bone where it wedged firmly in place (Fig. 7c).

Proper manipulations in the two preceding cases were essential to wedging the fragments into place and having them stay there with-

out support. Direct elevation with a blunt instrument usually results in splintering the overlapping edges or projections and prevents the fragments from being locked into position. In one such case seen recently, a fracture was sustained seven years before, and despite the manipulations of a surgeon, there were a squared nasofacial fold and complete nasal obstruction due to the approximation and the adhesion of the nasofrontal process to the septum. This was corrected by severing the adhesions than rocking the fragment loose and maintaining it in position by vaseline gauze packing until healing occurred.

Fig. 8. Case 6.

CASE 6. Depression of the Nasal Bone. S. P. D.; January 20, 1944. This 23-year old, white soldier fell, striking his nose against the edge of a cot. There was a laceration over the right side of the dorsum of the nose. Palpation on either side of the laceration revealed sharp edges of bone. A roentgenogram showed a transverse fracture through the right nasal bone at the junction of its middle and distal thirds.

This fragment was easily thrust into place with a rubber covered elevator. The depressed edge was unlocked by inserting the elevator in the corner where the nasal bone and the septum join, then applying force in a forward and medial direction (Fig. 8). This permitted the edges of the nasal bone to slip up to the edge of the nasofrontal process against which it was guided by the finger. It stayed in position without support. The laceration was treated by approximating the edges of skin and holding them in place with thin strips of flammed adhesive tape.

This type of fracture could only have been produced by a blow from a narrow edge or instrument. The reduction presents no great problem but again care must be taken to avoid breaking any spicules from the brittle edges of either the nasal bone or the nasofrontal process. These spicules are difficult to detect and if not fitted back into place they will be noted as irregularities or thickenings of the nasal dorsum after healing has occurred.

CASE 7. Depression of the Nasofrontal Process and the Nasal Bone on One Side. A. D.; November 23, 1943. This 28-year-old soldier complained of left nasal obstruction and left frontal headache. Three weeks before he had been punched on the nose and all his symptoms could be traced to that time.

The left side of the bony framework of the nose was depressed and a sharp edge could be felt at the midline of the dorsum of the

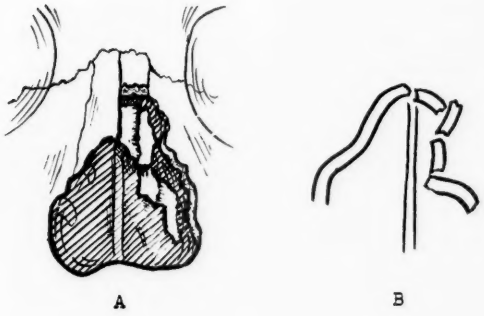

Fig. 9. Case 7.

nose. The usual double curve that represents the lateral aspect of the dorsum of the nose blending into the nasofacial fold was replaced by a definite angulation. The left nasal fossa was obstructed by the approximation of the left rima pyriformis to the septum. The infraorbital rim was intact. A roentgenogram showed a comminuted fracture of the left side of the nose (Fig. 9).

The dorsum of the nose was packed with a pledget of cotton saturated with ten per cent cocaine, then the anterior nasal nerve, the supratrochlear and the left infraorbital nerves were blocked with one per cent procaine. A rubber covered elevator was used and the comminuted fragments were thrust laterally and anteriorly against finger pressure applied externally. When the soft tissues were stretched, the fingers guided the fragments into approximation with one another and the restored arch was found to be self-sustaining. A Simpson splint was fitted carefully into the dorsum of the nose and left in place for 48 hours to prevent dislocation. After this time the rapid healing process and the edema were found to be adequate to insure against dislodgement except from unusual factors.

When this patient was examined there was no edema present and healing was far advanced. The absence of edema facilitated examination so that the exact nature of the injury could easily be determined and the subsequent alignment of fragments was simplified. When the arch does not maintain itself after manipulations of this type, it usually indicates that the positioning has been faulty; that is, the edges are not in apposition or there is under- or overriding.

Lateral Displacements.

CASE 8. Both Nasal Bones Broken Off as a Single Fragment. G. B.; March 11, 1943. While clambering out of the upper of a "double-decker" bunk this 22-year-old, white soldier fell, striking his head on the left side so that his spectacle frames were pushed with great force against his nose. There was an arch-like laceration from the medial end of the left brow down to the infra-orbital rim. The bony dorsum of the nose was displaced to the right; it moved easily and with distinct crepitation. A roentgenogram showed a complete separation at the nasofrontal suture lines of the lower two-thirds of the nasal bones (Fig. 10).

Fig. 10. Case 8.

Management was simple and entailed merely the relocation of the fragments by finger pressure. A molded stent splint was applied to insure against dislocation.

It is interesting to note that the heavily locked upper third of the nasal bones was not affected despite the tremendous force. As noted above this may be attributed to the thickness of the upper ends of the bones and to the firm abutment against the nasal processes of the frontal bones (Fig. 1 C and D).

CASE 9. Nasal Bones Broken as Separate Fragments. J. S.; February 15, 1944. One hour before examination this 29-year-old soldier was struck in the nose by a fist. The dorsum of the nose appeared twisted to the right. Palpation revealed a depression of the left nasal bone below the level of the left nasofrontal process. The free edge of the latter could be palpated. The right nasal bone was overriding the right nasofrontal process. Roentgenograms showed fracture lines but in no way gave any clue as to the relation of one fragment to the other. Fig. 11 shows the relationship of the pieces of bone.

The left nasal bone was elevated into position against the nasofrontal process and then the right fragment was pushed into place by external digital pressure.

The temptation in handling cases of this sort is to try immediately to reduce it by external pressure alone on the overriding frag-

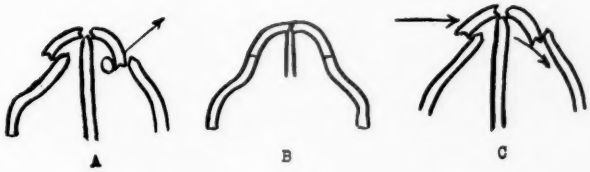

Fig. 11. Case 9.

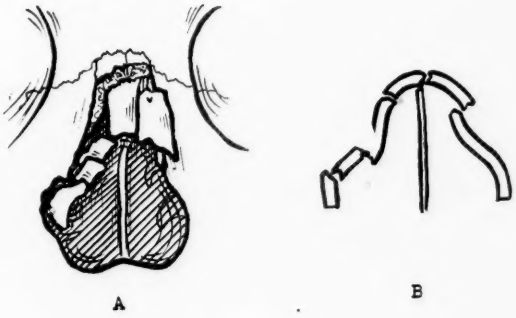

Fig. 12. Case 10.

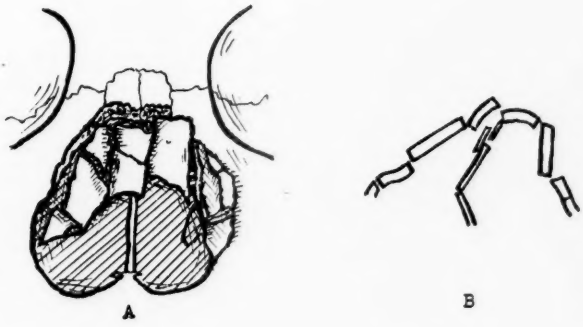

Fig. 13. Case 11.

ment. The basis for this is, of course, the fact that this is the most obvious deformity. Reference to Fig. 11c will show clearly why such pressure would not only not reduce the fracture, but would increase the locking of the depressed fragment. This maneuver thus increases the difficulty in reducing the depression. In many similar cases, it has been noted that after the depression was reduced nothing had to be done to the overriding pieces for they snapped back into position without being touched.

CASE 10. Fracture of Both Nasal Bones and the Nasofrontal Process on One Side. L. B.; June 27, 1943. While playing baseball this 19-year-old, white soldier was struck by a hard pitched ball. There was a marked depression of the right side of the nose with a flattening of the nasofacial curve and a convex twisting of the nose to the left. Palpation and roentgenograms revealed that there was a comminuted fracture of the right nasofrontal process and the right nasal bone and an overriding of the intact left nasofrontal process by the left nasal bone (Fig. 12).

The depression of the right side of the nasal vault was first corrected by elevating the comminuted fragments with a rubber covered elevator, stretching the soft tissues enveloping them so that the fingers placed externally could line up the fragments to reform the arch. The overriding fragment of bone on the left was easily thrust into proper position by finger pressure. A Simpson splint was inserted along the dorsum on the right side to prevent dislocation of the fragments; then a molded stent splint was applied.

CASE 11. Complete Comminution of all Nasal Bones with Lateral Displacement. L. B.; June 26, 1943. During some "horseplay" this soldier was kicked in the nose. He was treated two hours after injury. There was a marked depression of the nasal dorsum on the right side and a convexity to the left side. Palpation revealed bony crepitus over the entire bony framework. A roentgenogram showed extensive comminution of all the nasal bones. The septum was buckled to the right (Fig. 13).

Reduction was accomplished by elevating the arch on the depressed side enough to stretch the soft tissues as the fragments were guided into position with the finger tips. Counterpressure between the elevator and the fingers through the nasal wall was often necessary to fit the fragments together. After the fragments on the depressed side were all unlocked, very little pressure was needed to set the overriding fragments on the left side into place. Pressure on

Fig. 14. Case 12.

the convex side at the apex of the buckling straightened the septum. Simpson's splints were used bilaterally and a molded stent splint externally. Twenty-four hours later the intranasal splints were removed. The protective stent was used for eight days.

CASE 12. Comminuted Compound Fracture of the Nose. R. J.; March 14, 1944. A 36-year-old soldier was beaten in a tavern brawl and received multiple lacerations of the face and nose. He was treated eight hours after injury.

There was a ragged laceration across the dorsum of the nose starting about one inch below the glabella and extending downward and to the left for 3/4 inch. Protruding from the laceration was a piece of bone. The roentgenogram showed that this was the lower third of the left nasal bone which had been stripped of its periosteum. In other respects this case was similar to Case 11; that is, there was extensive comminution of all the bony framework of the nose.

Because the flat noncancellous portion of the nasal bone was completely stripped of its periosteum, it was felt that it could not stay in place without acting as a foreign body and eventually sloughing out. Accordingly it was picked out of the laceration. The fracture was then reduced as in Case 11. The absence of the lower third of the one nasal bone did not interfere materially with the reforma-

tion of the arch of the nose. Sulfanilamide powder was sprinkled into the wound and then its edges were carefully approximated with horse hair sutures. Simpson splints were inserted, the wounds were covered with vaseline gauze and then the stent was applied over the usual cotton batting butterfly. The intranasal splints were removed in 24 hours; the sutures were taken out on the third day, and the stent was not used after the eighth day. The cosmetic results were excellent.

In these injuries where there is extensive comminution, we see fulfilled the conclusions derived from manipulation of the models discussed above. Here, by careful approximation of the fragments, the arch of the nasal framework is restored and there is no tendency for the deformity to recur. The reformed arch is loose and may easily be broken down again, but to protect against this eventuality the intranasal pack or Simpson's splint and the external molded splint are found to serve well. Thus the various cumbersome devices and the attendant technical difficulties are all avoided.

SUMMARY AND CONCLUSIONS

1. The bony dorsum of the nose when shattered should not be thought of in terms of the dried anatomical specimen. In vivo the nasal bones are thin, flat bones sandwiched between layers of periosteum which are firmly adherent.

2. It has been shown in models and in vivo that an arch of thin bones, if broken, can be restored to shape by fitting the fragments together. This arch will maintain itself because the adherence of the fragments to the soft structures on each side keeps them in their relative positions.

3. The ridge pole, the perpendicular plate of the ethmoid, is unimportant for the preservation of the bony arch.

4. The lining of the bony dorsum is a mucoperiosteal layer and is subjected to great changes in thickness. This edema serves as a splint.

5. One hundred thirty nasal fractures of many possible types have been managed in keeping with these principles with good cosmetic and functional results and without the use of any headgears, clamps, wires or sutures.

6. The orthopedic technique of management of 12 representative cases has been described, the advantages for the method selected have been pointed out and the possible pitfalls in management indi-

cated. The cases have been grossly classified as: direct depressions, lateral depressions, and lateral displacements.

STATION HOSPITAL.

REFERENCES

1. Blair, V. P., and Brown, J. B.: Nasal Abnormalities, Surgery, Gyn. & Obst. 53:793, 1931.

2. Erick, J. B., and Austin, L. T.: Traumatic Injuries of Facial Bones, Philadelphia, W. B. Saunders & Co., 1944, p. 248.

3. Fomon, S.: Surgery of Injury and Plastic Repair, Baltimore, Williams & Wilkins Co., 1939, p. 268.

4. Gerrie, J. W.: One Hundred Broken Noses, Canadian M. A. J. 37:433 (Nov.) 1938.

5. Greismann, B.: Muscles and Cartilages of the Nose from the Standpoint of a Typical Rhinoplasty, Arch. Otolaryng. 39:334 (April) 1944.

6. Joseph, J.: Quoted by Fomon, S.: Cit. Ref. 3, p. 633.

7. Kazanjian, J. H.: Lateral Pressure Splint for the Nose, Arch. Otolaryng. 27:474, 1938.

8. Mason: Transfixing the Nose, Ann. Anat. & Surg. Soc. of Bklyn., March, 1880.

9. Metzenbaum, M. F.: Recent Fracture of the Nasal Base Lines of Both Outer Nasal Walls with Divergent Displacement, Arch. Otolaryng. 34:723 (Oct.) 1941.

10. Nievert, H.: In Kernan's Surgery of the Nose and Throat, New York, Thomas Nelson & Sons, 1942, p. 224.

11. Schwartz, J. J.: The Broken Nose, Minn. Med. 18:101, 1937.

12. Straith, C. L.: Automobile Injuries, J. A. M. A. 108:101, 1937; 109:940, 1937.

13. Straith, C. L., and deKleine: Modern Management of the Fractured Nose, Internat. Abstr. of Surg. 66:9 (Jan.) 1938.

14. Waldron, C. W.: Injuries of the Nose, Minn. Med. 25:258 (April) 1942.

15. Watkins, A. B. K.: Treatment of Severer Cases of Fractures of Nasal Bones, Brit. M. J. 2:917, 1933.

16. Whitham, J. D.: Treatment of Fractures of Face and Nose, Laryngoscope 49:394 (May) 1939.

17. Williams, Watson: Broken Nose, Brit. M. J. 2:791, 1931.

18. Womack, D. R.: A Fracture Device for the Nose, U. S. N. Med. Bull. 41: 852 (May) 1943.

XLVIII

RUPTURE OF THE TYMPANIC MEMBANE DUE TO BLAST

A MECHANICAL HYPOTHESIS

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The following hypothesis is an attempt to explain why, during bombing, when windows are broken, these usually fall outward rather than inward and to relate this phenomenon to the bursting of ear drums which are also usually ruptured outward into the external auditory canal.

An attempt will be made to show that no negative pressure is necessary to explain the rupture of the tympanic membrane during the blast but that the membrane is ruptured by the pressure entering the middle ear through the eustachian tube. That the rupture is possible by this route is well known. Some of the examples are by inflation, sneezing and the blowing of brass instruments.

To be acceptable, this hypothesis should explain:

1. The mechanics by which the tympanic membrane is ruptured outward.

2. Why, in cases of ruptured drumheads during blasts, there is less cochlear trauma than in the case of the unruptured drumheads.

3. Why, in some cases, the rupture is unilateral and in others bilateral.

At a later time I wish to suggest a simple method whereby this hypothesis can be proved and a possible means by which this type of damage can be prevented.

In this analysis no consideration is given to those unilateral ruptures such as occur when the patient is struck on the side of the head or when an explosion (localized) exposes only one side of the head to the force of the blast and, consequently, drives the drumhead inward. This type of unilateral injury, seen in civilian life, is readily understood and explained. This hypothesis relates only to those cases in

which the whole body is immersed in the blast, such as in aerial bombing, mortar explosions, or immersion in water during concussion.

Miller[3] explains the phenomenon of windows falling outward in the following manner: "Window panes may be cracked by the positive pulse and the fragments, before these fall inward, are pulled outward by the more prolonged negative pulse which immediately follows" Practically all other authors writing on this subject concur essentially in this explanation.[12]

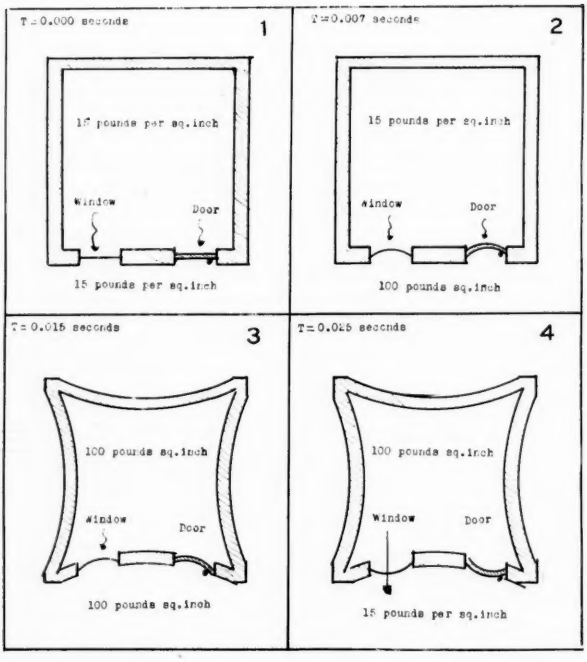
However, this explanation does not meet all the conditions. If it were true, then during the negative phase of an explosion we could expect to find all objects having a specific gravity equal to, or less than, glass pulled in the direction of the explosion.

We could expect pieces of paper, fabrics, hats and clothing to conform to the same behavior as glass. This, we know, is not the case.

The phenomenon, often reported in the popular press, of a woman and her escort simultaneously exposed to the force of the blast, the woman having the clothes stripped from her or raised over her head while the man's clothing remained intact, is not explicable on the suction wave or negative pulse theory. It is axiomatic that the maximum vacuum which can be produced is 15 pounds to the square inch. Since this force acts on the *outside* of the clothing, it should affect the clothing of both persons in the same manner. Further, a force of 15 pounds to the square inch acting on a piece of porous material is not sufficient to tear fabric apart. The phenomenon is, however, explicable on the basis of a positive pulse hypothesis and will be explained later.

In order to analyze what may take place under a certain set of conditions, let us set up the following theoretical situation. In Figs. 1, 2, 3, and 4 we have a single room with one window and one door. Of all the structures incorporated in the room, the window is the most fragile. During the first part of the experiment both the window and the door are to be considered closed.

In the case of a bomb blast occurring near the building, the pressure of the blast will vary with the amount of the explosive and the distance from the point of the blast to the building. But, for the purpose of setting up a hypothetical case, we will suppose that the building is subjected to a force equal to 100 pounds to the square inch.



Figs. 1-4.—Diagram showing theoretical effect of blast on walls and openings of room.

In the diagrams the atmospheric pressure will be designated as 15 pounds per square inch and the time as *T*, this being the amount of time which has elapsed since the onset of the blast. These figures in relation to the diagram are arbitrary and are taken from Miller's[3] work at Sandy Hook, wherein he states that the blast exerts its maximum force within 0.015 seconds after the beginning of the explosion and that the atmospheric pressure returns to normal after 0.025 seconds.

Fig. 1 represents a theoretical situation immediately preceding the bombing and the pressures within and without the building are atmospheric and equal.

In Fig. 2 the blast has occurred and a period of 0.007 seconds has elapsed. The window, being the weakest and most flexible, even if brittle, part of the structure, first begins to feel the force of the explosion and is the first part of the structure to be pushed inward. Tbe walls, being more rigid, are not so quickly affected. But all structures in the path of the blast begin to move inward as shown in Fig. 3.

In Fig. 3, 0.015 seconds have elapsed since the beginning of the explosion, the blast is considered to have reached its peak, and the walls, the window and the door move inward until the pressure within the building approximates that outside the building. For the sake of simplicity, we will say that amounts to 100 pounds per square inch. It is at this stage that the blast has reached its maximum.

In Fig. 4, 0.025 seconds have elapsed since the onset of the blast and the force of the explosion having spent itself, the pressure outside the building has returned to normal. From the conditions of the experiment we know that, of all the structures involved, the walls have the greatest mass, the greatest rigidity and, consequently, the greatest inertia. Under these conditions, the walls would be the last structure to be affected by this lowered outside pressure and, consequently, would tend to keep the air within the building under compression. The window, however, being the most fragile part of the structure, is now under the force of atmospheric pressure (15 pounds per square inch) on its outside surface and a pressure of approximately 100 pounds to the square inch on its inside surface. Under these conditions only one thing can occur and the window, now forced outward by this pressure differential between the outside and the inside of the building and being brittle, is broken and the fragments fall outward.

While the above results are those usually reported, there are also cases on record where the windows are forced inward. In fact, situ-

ations are recorded[4] where, under the influence of the same blast, the glass of the windows on the lower floor have fallen outward while the glass on the floor immediately above has fallen into the rooms. While, on the face, these results seem contradictory, they can be explained by this positive pressure hypothesis.

It follows that there must be conditions intermediate between the two extremes wherein the windowpane is neither pushed inward nor outward but remains unbroken.

The reason for this is as follows:

If, in Figs. 1 to 4, we now consider the door as being open but all other conditions exactly as in the other experiment, an entirely different set of results will follow. With the door open, it is not possible at any time to build up within the room pressure essentially different from that outside, since, with this large opening, the force of the blast will enter the room and pressures will tend to equalize themselves.

At the first impact of the blast on the flexible and brittle window, having no counterpressure on its inside surface, the window is shattered by the force of the blast and the fragments fall inward. Or, should the door be small so that some pressure would tend to be built up as the result of the in-moving walls, a condition might result wherein the pressure within the room equaled the pressure outside and the windowpane would remain intact. The constricted door opening would act as a pressure regulating valve.

This difference in action when the door is closed or open should be clearly understood, since the mechanics are similar to those which we might expect to find operative when the factor of nasal obstruction is applied to the rupture of the tympanic membrane.

If this hypothesis is correct, the whole phenomenon of outwardly broken windowpanes can be explained without a negative pulse being present. It is, of course, realized that the records, as shown by the phonodeik,[3] do indicate a negative phase. Still, the negative phase shown in the graphs may also be interpreted as being the compression wave of the blast imposed upon the natural period of the diaphragm.

When we now apply this positive pulse theory to the ripping of clothing from the persons of women and not of men, the phenomenon becomes clear. In the case of women's clothing, the whole bottom of the skirt is open and is many times the area found in the case of

men's,* which is the space at the bottom of the trouser legs. In the 0.015 seconds during which the blast reaches its peak, the volume of air under pressure entrapped beneath the skirts of the women is many times that entrapped within the trousers of the men and, since the pressure is released simultaneously, this greater volume of air under high pressure beneath the skirt would be more likely to destroy or tear the fabric.

This would be comparable to two tanks, one having a capacity of 1,000 cubic feet of air, the other having a capacity of one cubic foot of air, both being under a pressure of 100 pounds to the square inch. If the tanks would be exploded simultaneously, it is obvious that the tank with the larger volume of air would do the greater damage. This same analogy can be applied to the clothing of the two sexes.

To reiterate, before this hypothesis could be applied to the human body, it would have to clearly explain some of the following phenomena as these affect the ear:

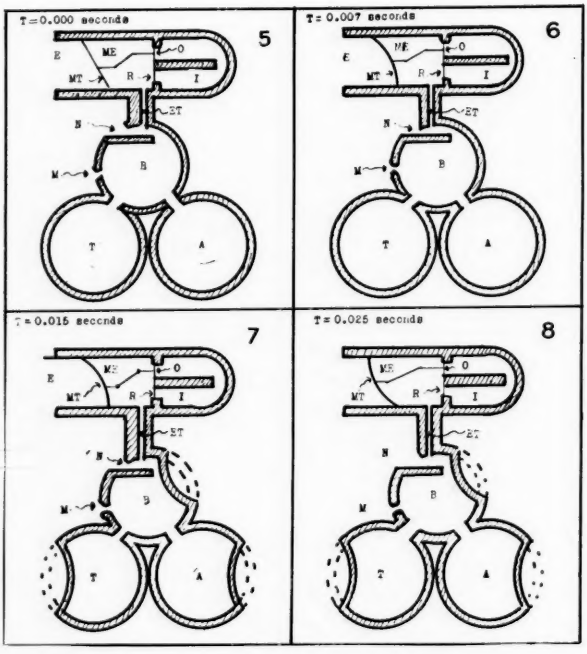
1. The mechanics by which the tympanic membrane is ruptured outward.

2. Why, in cases of ruptured drumsheads, there is less cochlear trauma than in the case of the unruptured drumhead.

3. Why, in some cases, the rupture is unilateral and in other cases bilateral.

Figs. 5 to 8 inclusive are a highly diagrammatic attempt to show an analogy between the building (Figs. 1-4) and the human body. In these diagrams (Figs. 5-8) the walls of the cavities *A*, *T* and *B* are analogous to the walls of the room in Figs. 1 to 4. These thick-muscled walls and the thin, flexible tympanic membrane are the outer surfaces of these interconnected human cavities. The drum can be compared to the windowpane, except that this window opens off a small room which is connected with the main cavities by a narrow, constricted passage, the eustachian tube. Further, this window or tympanic membrane is recessed at the inner end of an alcove, the external auditory canal. The door corresponds to the mouth and the nasal openings.

*If we suppose that the diameter of the bottom of a woman's skirt is about two feet, the area would be approximately three square feet. In the case of the bottoms of the man's trouser legs, the effective area is approximatly one-half square foot. The relation between the areas is about six to one. Actually the ratio is greater since there are friction factors which would probably raise this ratio to greater than ten to one.



Figs. 5-8.—Diagram showing relationship of body cavities to the tympanic membrane. *A*, Abdominal cavity; *T*, Thoracic cavity; *B*, Buccal cavity; *N*, Nose; *M*, Mouth; *ET*, Eustachian tube; *E*, External auditory canal; *ME*, Middle ear; *O*, Oval window; *R*, Round window; *MT*, Tympanic membrane; *I*, Internal ear.

Further, the tympanic membrane is a flexible structure while the windowpane is brittle, even if yielding within certain limits. Therefore, the first will shatter while the second will tear if forced beyond its yielding point.

If we disregard the small changes due to the movement of the diaphragm, the pressure within the four cavities in which we are interested is, for all practical purposes, atmospheric. This is the condition shown in Fig. 5. The time here is immediately preceding the blast.

In Fig. 6, 0.007 seconds have elapsed since the onset of the blast and all the outside walls of the body are considered as being subjected to the effects of the blast. Of all these outside walls, the tympanic membrane is the weakest and is the first to feel the effect of the blast. As it begins to move medially, the action of the blast is begun to be felt by the other walls of the interconnected cavities (*A*, *T* and *B*).

In Fig. 7, 0.015 seconds have elapsed since the beginning of the explosion and all the outside cavities are subjected to the full pressure of the blast. The tympanic membrane (*MT*) has been pushed inward until its movement has been stopped by the counteracting internal pressure due to the compressing of the air in the middle ear and the pressure due to the inward movement of the walls of the cavities *A*, *T* and *B*, which has by now forced the compressed air through the eustachian tube into the middle ear. (Analyzing this stage from the purely mechanical point of view, I think that it can be shown that it is at this point the most damage is done to the structures of the internal ear.) The force of the explosion having reached its peak, the pressure outside the body now begins to subside.

This is the situation that we find in Fig. 8 when 0.025 seconds have elapsed since the onset of the blast. The nasal passage is obstructed and the mouth is considered closed. The pressure outside the body has now returned to normal. However, due to the greater inertia of the thick, muscular walls and conceivably also due to the muscular contraction of the walls, these are slower to move outward than is the thin-walled tympanic membrane and, since the pressure within the bony cavity of the middle ear (*M*) is still the same as when the blast reached its height, the drum (*MT*) is forced outward and, since it has no supporting structures on its lateral surface, is, if the pressure is sufficiently great, ruptured outward.

Should laboratory experiments confirm this interpretation as being a logical explanation of the rupturing of ear drums during explosive blasts, it may be the means of explaining the different degrees

of trauma to the cochlear structures. It is with this in mind that an attempt will be made to relate this hypothesis to observations already made by otologists in bombed and shelled areas.

Analyzed from the purely mechanical point of view, trauma to the ear which is due to blast enveloping[8] the whole body can be divided into four main groups, each group resulting in varying degrees of injury, depending upon the intensity of the blast and the anatomical variations which are present. In all these four groups the mouth is considered closed.

GROUP 1. *No Rupture. Little Trauma.* Air compressed in cavities *A, T* and *B* is forced into the nasopharynx and the pressure is relieved through the nasal passage. Little air under pressure can be forced through the eustachian tubes to the middle ears.

Under Group 1 probably come most of the persons who have been subjected to blast and in whom the symptoms are merely transitory and would not be reported.

GROUP 2. *Rupture of Both Drums. Little Permanent Injury.* Air is compressed by blast in cavities *A, T* and *B* and is forced into the nasopharynx, but owing to nasal obstruction due to a deviated septum, enlarged turbinates or other pathological conditions, it is then forced through the eustachian tubes into the middle ears and ruptures both drums, thereby relieving the pressure to the internal ear structures.

Silcox and Schenck[9] give two examples of bilateral rupture of the tympanic membranes with audiometric charts. In the first, Case 2, for the frequencies of 128, 256, 510, and 1024 d.v. there is an average loss of 30 decibels. In the second there is an average loss of about 45 decibels for the frequencies from 128 to 2896 d.v.

GROUP 3. *Rupture of One Drum (Unilateral Rupture). Less Permanent Injury to Ruptured Side.* Air is compressed by blast in cavities *A, T* and *B* and is forced into the nasopharynx but, owing to nasal obstruction due to a deviated septum, enlarged turbinates or other pathological conditions, is unable to leave through the nasal passages and is forced into one eustachian tube, lymphoid tissue acting as a valve or curtain over the pharyngeal orifice of the other tube.[5]

A greater percentage of air under pressure is forced into the more patent eustachean tube and ruptures that drum and so relieves the pressure on the oval and round windows in that ear. In the ear with the less patent tube, the same conditions which interfere with the entrance of air would interfere with its egress and, therefore, the air would be confined in the middle ear for a longer period of time and

it is conceivable that it is this time factor[2] which is responsible for the destruction of the internal ear structures.

Of the 33 cases tabulated by Silcox and Schenck[9] showing unilateral rupture of the tympanic membrane, on only 12 were they able to obtain audiograms. In practically every case, with the exception of those ears which were infected, there is greater loss of hearing in the unruptured ear than in the ruptured. This would be in keeping with this hypothesis, since the air under pressure would remain longer in the middle ear of the unruptured drum and thereby be able to continue pressure for a longer period on the organs of the internal ear, thereby traumatizing or destroying these structures.

GROUP 4. *No Rupture, with Much Trauma of the Structures of the Internal Ear. Injury Permanent. May Be Unilateral or Bilateral.* The large volume of air compressed by the blast in cavities *A*, *T* and *B* is forced into the nasopharynx and, due to nasal obstruction and a closed mouth, it is forced into one or both eustachian tubes. However, due to counterpressure set up in the external auditory canal by the presence of wax, the hands clasped over the ears, or immersion in water, there is produced a counterforce against the lateral face of the drum and the compressed air in the middle ear is thereby confined. This air presses laterally against the medial surface of the tympanic membrane but is unable to rupture the drum due to the counterpressure on its lateral surface. This pressure also acts medially against the round and oval windows and through these on the structures of the internal ear.

In Silcox and Schenck's[9] Case No. 4 the seaman was completely immersed including his head when his ship blew up. Under these conditions, the force of the blast pressed against the flexible abdominal, thoracic and buccal walls and also against the lateral surface of the tympanic membrane. Also, being under water, his mouth must have been closed. Therefore, air compressed in the body cavities would be forced through the eustachian tube into the middle ear and at the same time the pressure of the blast would tend to confine the lateral movements of the tympanic membranes. In spite of the fact that there was a small perforation in the right ear, there was no appreciable difference in the hearing loss between the ears. In this case the pressures upon the structures in both internal ears were equal for all practical purposes. As a result there was bilateral deafness. Since water is practically incompressible, this patient must have felt the full force of the blast.

If in any of the above groups the mouth should be open there would be little trauma from this type of blast since the air com-

pressed in the cavities *A*, *T* and *B* would escape through the mouth. It would, therefore, seem logical that the best form of protection would be some form of ear stopper to protect the lateral surface of the tympanic membrane and a bite block to keep the mouth open. That there should be no nasal pathology naturally follows. Negus[4] reports that the presence of nasal obstruction contributed to the incidence of tympanic lesions, 65 per cent of the patients having this abnormality The practice of placing a pipe or pencil between the teeth when the fall of bombs seemed imminent was found to diminish the incidence of tympanic injuries and was widely employed both in town and at the front.

In the bombing of Barcelona it was also found that tympanic injuries were more frequent in men than in women, probably the latter were more likely to cry out at the approach of the bomb, thus maintaining the balance of the atmospheric pressure on both sides of the tympanic membrane.

All observers are agreed that (1) less cochlear damage occurs when the drum is ruptured. The most widely accepted explanation is (2) that the blast is intensified when it enters the narrow external auditory canal and that the force of the blast is dissipated by the rupture of the drum.[1, 3, 4]

Neither the first nor the second point fits into what we know regarding the passage of fluids, gases and sound through tubes. We know that the smaller the diameter of the tube, the greater will be the resistance to the passage of the gases and the noises passing through them.[6, 7]

It would seem reasonable to believe that if the pathway of the blast was primarily through the external auditory canal the rupture of the drum should allow a greater percentage of the force to reach the structures of the internal ear. Hanblen-Thomas[4] calls attention to the importance of the tympanic membrane in protecting the ear from noises. He had several men employed on anti-aircraft guns, who had large perforations of the drum. They complained bitterly of the noise, much more than ordinary individuals, and some of them had little loss of bone conduction.

This hypothesis does make it possible to explain why, during a blast, there is less cochlear damage if the drum is ruptured than if it is intact. If we accept the standard theory that the function of the round window is to equalize the pressure imposed on the semicircular scalae (and canals) by the compression imposed on the oval window by the ossicular chain, then the explanation becomes clear.

In Fig. 7, the air entering through the eustachian tube is compressed in the middle ear and acts equally upon the oval and the round window. The round window does not have an opportunity to move and absorb this shock since it itself is under a pressure equal to that of the oval window and, consequently, the fluids in the semicircular canals are under a pressure equal to that in the middle ear. However, if, for any reason, the drum is ruptured at this stage, the pressure in the middle ear would be released and it is logical to suppose that there would be less trauma.

That there is evidence to support the hypothesis that the pathway of the blast into the middle ear is through the eustachian tube is seen from the following case report by Negus.[4]

"The position of the rupture was of interest. He had seen it mentioned elsewhere that the rupture was more often in the posterior segment, but in the cases he had seen the rupture was more often in the anterior and inferior segment. For various reasons it would appear that the perforation was due to the positive wave and, as Mr. Colledge has pointed out, the eversion of the edges was probably due to suction wave. His diagram gave some idea of the appearance of the perforation, which was cleancut and showed very little reaction. *It was as if a ramrod or piston had pushed a hole through the tympanic membrane in the region of the Eustachian tube, where it was unsupported on the other side.*" (Italics author's)

It is interesting to note that observers who see these patients immediately after the injury or who see the edges of the rupture are agreed that the edges are everted.

Also of interest is the fact that thoracic surgeons who formerly leaned heavily on the suction theory to explain injuries have now discarded this theory.[8]

Before dismissing this angle of the problem, the quotation from an article by Barrows and Rhoads[12] deserves especial attention: "It was interesting to note that there was no wax in the external auditory canal of those having perforations of the ear drum." They explain this as being due to the suction wave lasting five times as long as the blast wave (0.006 sec. : 0.03 sec.). And again, "We are unable to find parts of the tympanic membrane or middle ear ossicles by the most careful examination in the patient with complete loss of both structures."

To anyone who has dissected and removed the ossicular chain and recalls how difficult it is to remove these bones from their anchorage, the idea that a suction wave of even 15 pounds to the square inch would be able to dislodge these bones is untenable. It is more logical to suppose that the wax, the tympanic membrane and the ossicles are blown out of the external auditory canal like a cork from a bottle.

Further, in actual field practice, advice given persons in the combat zone is based on this positive pressure hypothesis rather than on the positive pulse followed by a more prolonged suction wave theory.

Sailors thrown into the sea where there is danger of underwater explosion are advised to float on their backs. Experience has shown that persons in this position are less likely to be injured. In effect, when the swimmer is face down in the water, the soft, compressible portions of the abdomen, the thorax and the buccal cavity are subject to the force of the blast and by the compression of this confined air in these cavities the organs within are damaged.

On land, the British have found that the greatest protection is obtained by lying down on one side, with the knees drawn up and the hands covering the back of the neck and the ears. (To this might be added keeping the mouth open.) In this position the abdominal viscera are forced up against the diaphragm and a minimum amount of air is confined to be compressed in the body cavities. Clasping the hands over the ears would give lateral support to the tympanic membrane should the nose be obstructed and air forced into the eustachian tube, as well as prevent the direct force of the blast from entering the external auditory canal.

SUMMARY

During the period of blast:

1. The rupture of the tympanic membrane can be explained without a negative pressure being present.

2. The damage done, such as the removal of the ossicular chain, can not be explained by a negative pressure of even 15 pounds to the square inch but can be explained by this positive pressure hypothesis.

3. The pathway of the blast is through the eustachian tube and not through the external auditory canal.

4. Unilateral rupture of the tympanic membrane is due to the occlusion of the unruptured side because of pathological or anomalous conditions of the eustachian tube.

5. Nasal pathology may be responsible for the rupture of the tympanic membrane.

6. Internal ear damage can best be explained by this hypothesis.

7. To afford the maximum degree of protection the lateral surface of the drum should be protected from the direct force of the

blast; the person should assume a crouching position, thereby forcing the abdominal viscera against the diaphragm and expelling the maximum amount of air from the body cavities; and the mouth should be open and the nose clear so that the residual air compressed in the body cavities is not forced into the eustachian tubes and the middle ears.

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REFERENCES

1. Guild, S. R.: War Deafness and Its Prevention, Annals of Otology, Rhinology and Laryngology 50:70 (Mar.) 1941.

2. Perlman, H. B.: Acoustic Trauma in Man: Clinical and Experimental Studies, Arch. Otolaryng. 34:429-452 (Sept.) 1941.

3. Miller, D. C.: Sound Waves, Their Shape and Speed, New York, MacMillan Co., 1937, p. 113.

4. Colledge, L., et al: Injuries of the Ear: A Discussion, Proc. Roy. Soc. Med. (Sec. Otol.) 34:5 (Nov.) 1940.

5: Guggenheim, Louis: Therapy of Deafness and Personal Statement from Author, Reprint from The Laryngoscope, July, Aug., Sept., Oct., 1943.

6. Richardson, E. G.: Sound, 2nd Ed. London, Edward Arnold & Co., 1929, vol. 1, p. 27.

7. Dixon and Greenwood: Proc. Roy. Soc. Med. 105:199, 1924 & 109:56, 1925. Quoted by Richardson, see Ref. 6.

8. Zackerman, S.: Proc. Roy. Soc. Med. 34:171-191, 1941.

9. Silcox, L. E., and Schenck, H. P.: Blast Injury of the Ears, Arch. Otolaryng. 39:413-420 (May) 1944.

10. Palma, J., and Uldall, J. J.: Immersion Blast Injuries, U. S. Nav. Bull. 41:3 (Jan.) 1943. Quoted by Silcox & Schenck, see Ref. 9.

11. Alexander, A. B.: Brit. M. J., pp. 195-196, 1941.

12. Barrows, D. W., and Rhoads, H. T.: Blast Concussion Injuries, J. A. M. A. 125:900 (July 29) 1944.

13. Ballinger, W. L.: Diseases of the Nose, Throat and Ear, 4th Ed., Philadelphia, Lea & Febiger, 1914, p. 668.

14. Ballin, M. J.: Politzer's Textbook of Diseases of the Ear, 6th Ed., Philadelphia, Lea & Febiger, 1926, pp. 263-5.

XLIX

POSTBRONCHOSCOPIC REACTIONS

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Although the literature contains many reports on the use of bronchoscopy in the diagnosis and treatment of bronchopulmonary disease, very few of these contain evidence of harmful effects of this procedure. We were of the belief that endoscopy was not harmful unless definitely contraindicated until we had the misfortune of seeing a patient go rapidly downhill following bronchoscopy. This occurrence stirred us to an investigation of this problem.

Bronchoscopy is not an exceptionally heroic or dangerous procedure, but rather a simple and direct means of investigation for the treatment of bronchopulmonary disease. Since a lesion of the parenchyma of the lung always results in changes in the mucous membrane of the draining bronchus, and these change with changes in the pulmonary lesion, bronchoscopy affords an avenue for the direct study of the character and progress of a lesion in the lung.

Bronchoscopy has been performed at this institution for the diagnosis and treatment of tuberculous and nontuberculous pulmonary disease. For the former it has been used for diagnosis in cases in which the sputum is negative but x-ray findings show tuberculosis, as a routine before thoracoplasty and in the diagnosis and treatment of endobronchial tuberculosis. In the nontuberculous conditions it has been employed as a diagnostic measure and as a part of the treatment of patients with bronchiectasis and asthma where it was felt that, by aspiration of the secretions, the patient would obtain relief.

During the period from January 1, 1943, to January 1, 1945, a total of 361 bronchoscopies have been performed on 214 patients. Two hundred forty-five of these were on 147 patients with pulmonary tuberculosis. Since these form the majority of the patients and are those in whom the most reactions were observed, they will be considered first.

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Following 103 of the bronchoscopies in the tuberculous patients, a rise in temperature was noted. In 91 instances this occurred during the first 72 hours and the remaining 12 occurred equally from then to the eighth postbronchoscopic day. The temperature rise ranged from one-half to four and one-half degrees, there being 34 cases of a rise of one-half degree; 38 of a rise of one degree; 6 of a rise of one and one-half degrees; and 13 of a rise of two degrees. In three cases this elevation did not persist beyond the day on which the procedure was performed, in 36 the temperature had dropped by the following day, in 17 by the second day, and in 15 by the third day. In 9 cases the temperature had returned to normal by the fourth day and in 6 each on the fifth and sixth days. One patient had an elevation of temperature until the eighth day, two until the ninth, and three until the thirteenth day.

In addition to this initial rise in 22 cases there was a secondary rise after the temperature had returned to normal. In 16 of these this rise occurred between the ninth and thirteenth days following bronchoscopy, in 2 it occurred on the fifth day, and in 1 each on the seventh, eighth, fourteenth, and fifteenth days. The elevation of temperature ranged from one-half to six degrees, there being 6 with a rise of one-half degree; 9 with one degree; 2 with three degrees; and 1 each with two, two and one-half, three and one-half, five, and six degrees. The elevated temperature lasted from one to 42 days. In 15 cases it had subsided within a week and in 5 others by the end of the second week. One patient expired 19 days after bronchoscopy with the temperature still elevated. In one patient the temperature did not subside to normal until the forty-second day.

In the patients in whom this secondary rise occurred, four showed an extension of the disease in the lungs on x-ray examination. They are being reported in detail.

REPORT OF CASES

CASE 1. E. F., a white male, aged 47 years, was admitted to the hospital on November 17, 1944. He stated that pulmonary tuberculosis had been diagnosed in 1932 and following treatment, it had been declared arrested in 1933. About two months previously he had begun to have night sweats with a morning cough and the raising of quite a bit of sputum. During the past two days he had had chest pain and there has been a loss of eight pounds of weight in the past two months. X-ray examination revealed areas of cloudy density in both upper lobes with an area of decreased density behind the first interspace on the left. The initial routine of ten sputum specimens

were negative on direct smear. A 48-hour concentrated sputum specimen also was negative on direct smear. Because of the negative sputum in the face of the roentgenographic findings, bronchoscopy was performed on December 22, 1944. This was essentially negative except for a small amount of thin secretion in both main stem bronchi. Specimens of this secretion were negative for acid-fast bacilli on direct smear and guinea pig inoculation. The day following bronchoscopy the patient had a rise of temperature to 99.6° F., but by the third day this had fallen to 99° F. The patient continued to have this slight elevation of temperature until January 4, 1945, when it rose to 100.6° F. and the next day to 101.6° F. On January 6, 1945, a roentgenogram revealed an extension of the disease in the left lower lobe with possibly some increase in both upper lobes. The patient rapidly grew weaker with the temperature remaining elevated and expired on January 10, 1945.

Case 2. C. W., a white male, aged 46 years, was admitted to the hospital on March 12, 1943. In July 1942 he attempted to enlist in the army and at that time was told that he had tuberculosis. He was hospitalized for short periods of times at three different institutions, but each time he left of his own accord. For the past six months he has been losing weight and sputum has been blood streaked at times. Examination revealed signs of atelectasis over the right upper lobe without râles. X-ray examination revealed a homogenous increase in density over the right upper lobe. Sputum was copious and mucopurulent in character and was negative for acid-fast bacilli by all types of examinations, including culture and guinea pig inoculation. Reports from the other hospitals revealed failure to find acid-fast bacilli at these institutions.

Bronchoscopy was performed on March 31, 1943. The only abnormality noted was that the right main bronchus was slightly and concentrically narrowed and a moderate amount of secretion was seen to issue from the right upper lobe orifice. Examination of this secretion by direct smear and guinea pig inoculation failed to reveal acid-fast bacilli. Following bronchoscopy there was no immediate febrile reaction, but on the tenth day the patient's temperature rose to 104.4° F. This slowly and gradually subsided and the temperature was normal in nine days. It remained that way for about a week when again there was a rise to 102° F. This rise persisted for three weeks and thereafter the temperature remained between 99.6° and 100° F. until the patient's discharge six weeks later. A roentgenogram taken after the second course of elevated temperature showed possibly some clearing of the right upper lobe density. The patient

was discharged at his own request at which time a diagnosis of active pulmonary tuberculosis was given by a medical board on the basis of history, x-ray and physical findings, though in view of the atelectasis and the absence of positive sputum, the possibility of a mediastinal tumor was borne in mind.

CASE 3. M. R., a white male, aged 23 years, was admitted to the hospital on June 16, 1943. In February 1943, while stationed in an army camp in this country, he started losing weight and lost 20 pounds in five weeks. At this time he developed hiccoughs which persisted for four days and he was admitted to the station hospital. A diagnosis of pulmonary tuberculosis was made and the patient was transferred to this hospital. X-ray examination revealed areas of cloudy density over all lobes on the right and the upper lobe on the left. There was an area of decreased density behind the right first interspace. Sputum specimens were positive on direct smear.

Bronchoscopy was performed on July 14, 1943, and revealed a large amount of heavy caseous purulent material in the right main stem bronchus and marked congestion around the upper lobe orifice. The left main stem bronchus contained a small amount of seropurulent material and the mucosa was moderately congested. The day after bronchoscopy the patient's temperature rose to 101.6° F. but returned to 99° F. on the sixth day. On the twelfth day the temperature rose to 100.6° and remained elevated for eight days. An x-ray examination 18 days after bronchoscopy revealed an increase in the disease in the right lung. In spite of a right phreniclasia and pneumoperitoneum the patient's course was slowly downhill. On December 17, 1943, he developed symptoms of acute bowel involvement and laparotomy revealed gastro-intestinal tuberculosis with extensive involvement of the cecum. A cecostomy was performed, but the patient expired on January 24, 1944.

CASE 4. J. M., a white male, aged 46 years, was admitted to the hospital on June 22, 1943, complaining of weakness and cough. He had been a patient at this institution on several previous occasions but had left of his own accord. He stated that at the age of 13 he had been removed from school because of tuberculosis, but following pneumonia in 1937 a definite diagnosis of tuberculosis was made. X-ray examination revealed a density over the right upper lobe with a small cavity. Sputum specimens were positive for acid-fast bacilli on direct smear. Bronchoscopy was performed on July 3, 1943, and ulcerations and granulations were noted in the right main bronchus just below the carina. On the second day following bronchoscopy the patient's temperature rose to 101.6° F. but had become normal by the

eleventh day. On the thirteenth day there was a sudden rise of temperature to 103.8° F. and it slowly returned to normal by the thirty-second day. An x-ray film taken three weeks after bronchoscopy revealed a density in the region of the second and third interspace on the left, but a month later there was no increase in the disease in this region. The patient's course was gradually downhill and he expired in June 1944.

In an attempt to see whether the reactions just observed were caused primarily by the fact that the patients were tuberculous, the records of patients who had been bronchoscoped during the same period for nontuberculous pulmonary conditions were studied. The diagnosis in these cases was either bronchiectasis, asthma, pulmonary malignancy, lung abscess, or chronic bronchitis. One hundred sixteen bronchoscopies were performed on 67 patients. In 37 cases there was a rise in temperature during the first week following the procedure and in 32 this occurred during the first 72 hours. This rise ranged from one-half degree to four degrees; in 7 cases there was a rise of one-half degree; in 14, one degree; in 9, two degrees; in 5, three degrees; and in 2, four degrees. The temperature returned to normal within a week in 36 cases and in one it remained elevated until the sixteenth day after bronchoscopy. In only two cases was a secondary rise in temperature noted. One was a case of bronchiectasis and the other, a case of bronchial asthma. In the first there was a rise of temperature to 101.6° F. on the thirteenth day and a return to normal 15 days later. In the asthmatic the temperature rose to 102.6° F. on the eleventh day and remained elevated for fifteen days.

DISCUSSION

Prior to the report of Radner,[2] there had appeared only 11 cases in the American literature of spread of the tuberculous process following bronchoscopy. Radner discussed 183 bronchoscopies performed on 97 patients. There was an initial febrile reaction in 18 and a late rise in 26 cases. Twenty-one of the latter showed minimal infiltrative spread and 5, atelectasis of a lobe or a lung. His impression was that the disturbance of the cough reflex is very likely associated with the febrile reaction and the extension of the disease. Salkin, Cadden, and Edson,[3] in a report of over 2000 bronchoscopies performed in cases of tuberculous tracheobronchitis, found only one case in which there was a spread of the disease which might be attributed to the procedure. For several days after bronchoscopy there was an increase in cough and expectoration. Postoperative fever was present in eight

per cent of the cases, but it rarely went over 100° F. and was from one to three days' duration. Davies[1] found no evidence of harm in a single case in a series of 400 bronchoscopies performed on 156 tuberculous patients. A search of the literature does not reveal any report on the postbronchoscopic course of patients with nontuberculous pulmonary disease.

The initial rise in temperature can be explained in the majority of instances by the trauma of instrumentation, and this is borne out by the similarity of the reactions in the tuberculous and nontuberculous cases. The secondary rise is the important sign in the patients with tuberculosis. It appears to be an indication of a spread of the disease or at least a further activation of it. It may be of interest to mention that, in the 22 patients who showed the secondary rise, four had not had an initial rise in temperature, in ten the initial rise had not persisted over 72 hours, and in eight, the initial rise had lasted over 72 hours. The secondary rise in the nontuberculous patients can be attributed to a reactivation of the infection in the patient with bronchiectasis and in the asthmatic to a secondary infection having gained a foothold following the instrumentation.

The only suggestion which we can offer to prevent the further occurrence of these reactions is the more careful selection of patients for bronchoscopy. The disturbance of the cough reflex by the anesthetic may be a factor, so the minimal quantity necessary for the procedure should be used. The procedure should be done with a minimum of trauma and patients should be encouraged to clear the tracheobronchial tree of secretions as soon as possible.

SUMMARY

1. The results of 245 bronchoscopies in 147 patients with pulmonary tuberculosis and of 116 bronchoscopies in 67 patients with nontuberculous pulmonary conditions are reported.

2. In the patients with tuberculosis 103 bronchoscopies were followed by an initial febrile reaction during the first week and 22 showed a rise in temperature after this time. In the latter x-ray examination revealed an extension of the disease in four patients.

3. In the patients with nontuberculous disease there was a rise in temperature during the first week in 37 cases and a later rise in two cases.

VETERANS ADMINISTRATION.

REFERENCES

1. Davies, Roberts: Treatment of Tuberculosis Tracheobronchitis, Am. Rev. Tuberc. 48:94-108 (Aug.) 1943.

2. Radner, D. D.: Postbronchoscopic Reactions in Pulmonary Tuberculosis, Am. Rev. Tuberc. 47:370-378 (April) 1943.

3. Salkin, David, Cadden, A. V., and Edson, R. C.: The Natural History of Tuberculous Tracheobronchitis, Am. Rev. Tuberc. 47:351-369 (April) 1943.

L

THORNWALDT'S SYNDROME

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AND

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The purpose of this communication is to report on the pathologic anatomy of so-called Thornwaldt's disease and to emphasize that the syndrome—characterized primarily by occipital headache and postnasal discharge— is the same whether produced by inflammatory changes in the bursa or in the median recess. In other words, there is no difference in symptomatology when one or the other site is involved. Therefore the term Thornwaldt's disease is a misnomer, because it does not convey this impression from the clinical point of view. The more appropriate designation would seem to be Thornwaldt's syndrome.

This present study is based on 140 consecutive autopsies in which the nasopharynx was carefully examined, especially from a pathologic point of view.

In 1885 when Thornwaldt[1] reported his findings in 25 patients with disease of the so-called nasopharyngeal bursa, he endeavored to prove that in all situations an inflammatory process in the bursa was the cause of postnasal discharge. Thornwaldt's was purely a clinical study based on rhinoscopy and without pathologic examination of the involved structure. It was Luschka's[2] anatomic description of the nasopharyngeal bursa that led Thornwaldt to his conclusions. In his monograph Luschka described the bursa as an elongated pocket, lined with epithelium and with an orifice situated in the midline at the lower border of the pharyngeal tonsil, extending backward and attached to the periosteum of the occipital bone.

The nasopharyngeal bursa was described for the first time by Mayer[3] many years before Luschka. Mayer believed that develop-

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ment of the bursa is attributable to the attachment of the epithelium and the mucosa of the nasopharynx to the chorda dorsalis. In 1879 Ganghofner[4] expressed disagreement with the conclusions of Luschka and presented his opinion that the bursa is nothing more than a depression of the inferior part of the median recess of the nasopharyngeal tonsil.

Killian[5] tried to distinguish between inflammation of the bursa and changes in the nasopharyngeal recess which may be partially covered by adhesions and enlarged by retention of exudate and secretory products. He stressed the fact, furthermore, that the median recess has no relationship to the chorda dorsalis, but, on the other hand, the bursa is attached to the periosteum.

Fig. 1.—*A*, Very large pharyngeal bursa with many adhesions (Thornwaldt's disease). Specimen from a female, aged 56 years, who expired from bronchopneumonia.

Froriep,[6] in 1882, desribed the intimate relationship between the apex of a bursa and a mass of notochordal tissue.

Of the publications dealing with this problem, the more important is one by Poelschen.[7] He studied the pathologic changes (described by Thornwaldt) of the so-called nasopharyngeal bursa in autopsy material and concluded that the rhinoscopic-clinical observations of Thornwaldt have a sound morphologic basis, but it is irrelevant whether the inflammatory changes are in a true nasopharyngeal bursa or in a median nasopharyngeal recess. On histologic examination he found only lymphatic tissue, remnants of the nasopharyngeal tonsil. Half a century has passed since the original publication of Thornwaldt, and today we are no further enlightened on the problem. The questions now resolve themselves: "Are we dealing with a disease of the bursa or of the median recess? Is

there any difference in symptomatology when one or the other site is involved?"

Modern investigators in their writings have only added to the existing misunderstanding. In the opinion of Yankauer[8] a nasopharyngeal abscess develops from the median recess, while, according to Kully,[9] Dorrance,[10] and Eagle,[11] the pathologic changes arise from the nasopharyngeal bursa. In a more recent publication Godwin[12] tried to distinguish between pathologic changes in the nasopharyngeal bursa and those in the median recess and called attention to the characteristic headache syndrome associated with Thornwaldt's disease.

The original concept of the development of the nasopharyngeal bursa was that it arises from so-called Seessel's pouch which is present in the nasopharynx in an embryo of 14-28 mm. in length. Seessel's pouch is situated just beneath Rathke's pouch. But Arey[13] referred to Seessel's pocket (described by Seessel in 1877) as the blind upper end of the entodermal foregut which itself has nothing to do with the nasopharyngeal structure. According to Huber,[14] the pharyngeal bursa arises at a point on the posterior wall of the nasopharynx where the pharyngeal segment of the notochord has retained its connection with the pharyngeal ectoderm. Snook[15] examined the nasopharynx of 201 embryos between 15 mm. long and newborn and found that a nasopharyngeal bursa was present in 40 per cent of them.

Bursa pharyngea is rare. It is a diverticular-like structure in the midline of the posterior wall of the pharynx at the lower end of the pharyngeal tonsil, directed upward and backward. The apex of the bursa is attached to the periosteum of the occipital bone just before the pharyngeal tubercle of the body of this bone.

It should be stressed that neither the nasopharyngeal bursa nor the posterior median recess is in itself pathologic. In 140 autopsy specimens we found six small pharyngeal bursae 3 mm. or less in diameter, and four large pharyngeal bursae (i.e., larger than 3 mm. in diameter). In one of the latter group the bursa appeared to be inflamed, the orifice was narrowed, and there were numerous adhesions in Rosenmüller's recess (Fig. 1). Besides these bursae, there were observed seven small median recesses and two larger ones.

Differentiation between a median recess and a pharyngeal bursa is sometimes extremely difficult. In fact, without microscopic examination, differentiation is well nigh impossible. The specimen illustrated in Fig. 1 is from a female, 56 years of age, who expired from bronchopneumonia. Since we believed that this specimen represented a

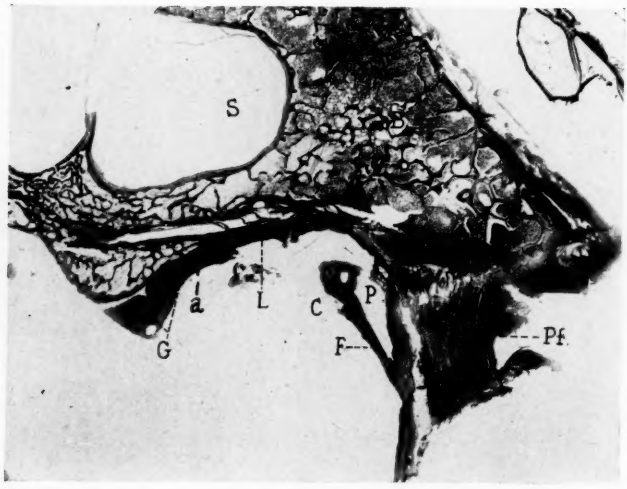

Fig. 2.—Sagital section through the base of the skull and the median recess (*P*). *S*, sphenoid sinus; *B*, body of sphenoid; *Pf*, Prevertebral fascia; *F*, Fold of mucosa containing a small cavity in *c*; *G*, Glands of the pharyngeal mucosa; *L*, Mucosa containing lymphatic tissue and covered by columnar epithelium; *a*, indicates the boundary between squamous and columnar epithelium.

Fig. 3.—Sagittal section through the base of the skull and the median recess (*P*). *S*, Sphenoid sinus; *B*, Body of the sphenoid; *Pf*, Prevertebral fascia; *Sc*, Mucosa covered by squamous epithelium; *L*, Mucosa containing lymphatic tissue and covered by columnar epithelium.

true case of Thornwaldt's disease, we undertook its histologic study. Grossly, the specimen presented a diverticular-like structure in the midline between the superior and the posterior walls of the nasopharynx. The mouth measured 5 x 6 mm. and the diverticulum itself was 0.6 mm. thick and filled with a mucous plug. There were adhesions in both Rosenmüller's recesses.

The histologic description of the specimen is as follows: The mucosa of the nasopharynx consisted of dense connective tissue in which large mucous glands were embedded. The larger part of the epithelium was absent, desquamated. In so far as it was present, it consisted of stratified squamous epithelium.

Between the superior and the posterior walls of the pharynx there was a pocket formed by folds of the mucosa and filled with detritus. In the area of the pocket the mucosa consisted of lymphoid tissue with few lymph follicles. The lymphoid tissue was infiltrated by polymorphonuclear leucocytes in moderate numbers. The apex of the pocket reached the prevertebral fascia (Figs. 2 and 3.)

Comment. This specimen is, we believe, of considerable interest and enlightenment because it shows that the gross pattern may be that of an infected nasopharyngeal bursa while the microscopic examination reveals remnants of a nasopharyngeal tonsil This finding leads to the assumption that this structure is a median recess, i.e., a result of the involution of the nasopharyngeal tonsil. In the wall of a typical nasopharyngeal bursa, lymphoid tissue is always present, even follicles. The presence of follicles warrants the assumption that we are dealing here with remnants of the nasopharyngeal tonsil.

The histologic examination of this specimen confirms our belief that clinical diagnosis of lesions in the nasopharynx often is unreliable. We endeavored to distinguish clinically between a median recess and a nasopharyngeal bursa. We were led to believe that a nasopharyngeal bursa is a circumscribed diverticular-like opening of the nasopharynx, while a median recess is a more shallow, irregular, groove-like or triangular deepening. We learned, however, by histologic examination of a so-called typical bursa that a median recess may closely resemble it. This demonstrates also that an infected pharyngeal bursa and an infected median recess may lead to the clinical-rhinoscopic and gross pathologic picture of Thornwaldt's disease, as it is now understood.

Because of this fact, we suggest, as more appropriate and accurate, the designation Thornwaldt's syndrome for what has hitherto been called Thornwaldt's disease. Only by further careful compara-

tive clinicopathologic studies, however, will it be possible to decide finally whether or not the distinction between infection of the median recess and infection of the pharyngeal bursa is of any significance other than pathologic.

SUMMARY AND CONCLUSIONS

1. The symptoms of so-called Thornwaldt's disease may develop on the basis either of an infected median recess or of an infected pharyngeal bursa.

2. The clinical-rhinoscopic picture and the gross pathologic pattern of both types of lesions are identical.

3. The microscopic examination of the mucosa lining the pocket is the only reliable means of differentiation between the lesions.

4. The designation "Thornwaldt's syndrome" should be substituted for "Thornwaldt's disease," to describe more accurately the process on clinical grounds, since the symptoms may be caused by infection in either the recess or the bursa.

5. Further studies may eventually determine the significance of both processes and aid in deciding whether their nature may have some, at present unknown, influence on their subsequent course and prognosis.

REFERENCES

1. Thornwaldt, G. L.: Ueber die Bedeutung der Bursa pharyngea für die Erkennung und Behandlung gewisser Nasenrachenraumkrankheiten, Wiesbaden, J. F. Bergmann, 1885.

2. von Luschka, H.: Der Schlundkopf des Menschen, Tubingen, Laupp, 1868.

3. Mayer, R.: Ueber die Bildung der Bursa pharyngea media, Anat. Anz. 37: 449, 1910.

4. Ganghofner, F.: Ueber die Tonsilla und Bursa pharyngea, Sitzungsber. d. math. Naturw. Kl. d. kaiserl. Akad. d. Wissenschafben 78:182, 1879.

5. Killian, G.: Ueber die Bursa und Tonsilla pharyngea, Morphol. Jahrb. 14: 618, 1888.

6. Froriep, A.: Kopfteil der Chord a dorsalis bei menschlichen Embryonen, Festgabe fur Jacob Henle, Bonn, 1882; quoted by Huber: Anat. Rec. 6:373, 1912.

7. Poelschen, R.: Zur Anatomie des Nasenrachenraumes, Virchows Arch. f. path. Anat. 119:118, 1890.

8. Yankauer, S.: Nasopharyngeal Abscesses, A Report of 155 Cases, Trans. Am. Acad. Ophth. and Otolaryng. 1929, p. 364.

9. Kully, B. M.: Cysts and Retention Abscesses of the Nasopharynx, J. Otol. and Laryng. 50:317, 1935.

10. Dorrance, G. M.: The So-called Bursa Pharyngea in Man, Arch. Otolaryng. 13:187 (Feb.) 1931.

11. Eagle, W. W.: Pharyngeal Bursae (Thornwaldt's Bursae); Report of 64 Cases, Laryngoscope 49:199 (March) 1939.

12. Godwin, R. W.: Thornwaldt's Disease. Characteristic Headache and Etiology, Laryngoscope 54:66 (Feb.) 1944.

13. Arey, L. B.: Developmental Anatomy, 4th ed., Philadelphia, W. B. Saunders Co., 1940.

14. Huber, G. C.: On the Relation of the Chorda Dorsalis to the Anlage of the Pharyngeal Bursa or Median Pharyngeal Recess, Anat. Rec. 6:373, 1912.

15. Snook, T.: The Later Development of Bursa Pharyngea, Anat. Rec. 58:303, 1934.

LI

OSSIFYING FIBROMA OF THE ETHMOID CELLS AND THE FRONTAL SINUS

REPORT OF A CASE

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A 13-year-old boy was admitted to the Illinois Eye and Ear Infirmary January 1, 1942, with the following history: For the past five years the right eye has appeared to be larger than the left. For two years he has had dizzy spells occurring about once a month, at any time of day and usually lasting about 30 minutes. For a year or more there has been partial obstruction of the right nasal chamber. Six months previously an operation was performed which the father thought was for the removal of nasal polyps.

On inspection the right eye appeared to be lower and farther from the midline than its mate and it also appeared slightly more prominent. A firm immovable mass was palpated in the nasal portion of the right orbit. Anterior rhinoscopy revealed a large mass obstructing the upper portion of the right nasal chamber pushing the septum over against the left lateral nasal wall.

Examination by the Eye Department showed the right cornea to be 16 mm. in front of the orbital margin and the left 15 mm. The right eye was 4 mm. lower than the left and 5 mm. farther from the midline. Ophthalmoscopy showed slightly blurred disc margins, the presence of a venous pulsation and a normal appearing macula. The vision of the right eye was 20/40-3 and of the left 20/20.

The x-ray film showed a marked clouding in the region of the right ethmoid cells, especially the anterior cells, and the right frontal sinus. The bone structure was distorted and thinned with apparent lateral spread of the ethmoid capsule. The right antrum was anatomically small with a thickened membrane. The conclusions of the roentgenologist were as follows: "The principal findings in the eth-

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moids are those of expanding pathology and the density is not great enough to suggest an osteoma. Therefore the findings are those of a mucocele or nonosseous tumor apparently of ethmoidal origin."

No more definite preoperative diagnosis was made than that ventured by the roentgenologist.

An external fronto-ethmoid approach similar to that used by Jansen and later by Lynch was decided on. This was carried out under local anesthesia after sedation with morphine, scopolamine and sodium amytal. The usual curvilinear incision, extending from just below the medial end of the right eyebrow down along the side of the nose for a distance of 1¼ inches was made. The periosteum was elevated from the inner orbital wall and the floor of the frontal sinus. The naso-orbital wall was found to be intact but it was displaced laterally 7 or 8 mm. On opening the ethmoid capsule a soft tissue tumor was found which involved all the ethmoid cells as well as the frontal sinus. The growth was rather friable but it had exerted considerable pressure mesially as well as laterally, so that the middle turbinate was thinned out against the upper portion of the septum which was pushed well over into the left nasal chamber. Most of the ethmoid cell partitions were destroyed but a few were partially intact although all the cells were invaded.

The growth was first dissected from the frontal sinus and this portion removed after which the expanded ethmoid capsule was thoroughly removed. The thinned out middle turbinate was removed and at the conclusion of the operation the nasal chamber, the ethmoid area and the frontal sinus formed a single smooth-walled cavity. The maxillary and sphenoid sinuses were not invaded but the antro-ethmoidal wall was pushed laterally and downward.

The gross specimen consisted of several pieces of a large tumor somewhat fibrous in consistency though not very dense nor very vascular. There did not appear to be a definite capsule and there were hollow spaces running irregularly through some portions.

The patient made an uneventful recovery. A picture taken three weeks after the operation still showed some downward displacement of the right eye.

The pathologists report was fibro-osteo-sarcoma, slow growing but malignant.

The boy was discharged from the hospital three weeks after the operation and returned to his home in southern Illinois. He has returned every few months for examination. In November 1942, ten

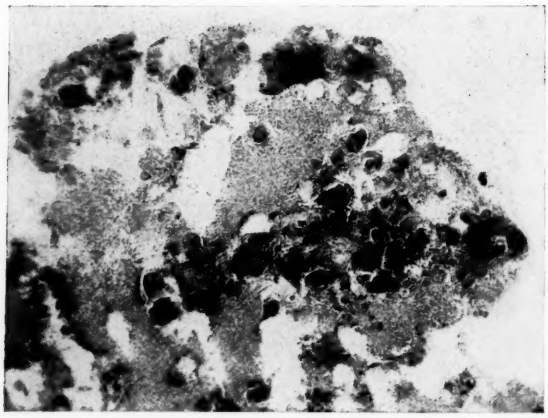

Fig. 1.—Section of the fibroma showing scattered areas of ossification.

months after the operation, there was a small growth of what appeared to be simple hyperplastic mucosa in the upper anterior portion of the nasal cavity and this was removed and sent to the laboratory. At this time Dr. Georgianna Theobald, who did not make the original microscopic examination, reviewed the sections of the original tumor and was of the opinion that it was not malignant. Because of this difference of opinion she sent the original slides as well as the sections of the specimen recently taken for biopsy to Colonel Ash. He replied: "I believe I would diagnose the large specimen as an ossifying fibroma. It is true that the blood vessels are of the sarcoma type but I doubt that it will metastasize though, of course, as you have already learned, it will be extensively expansile and destructive. The second specimen is simply a fragment of sinus mucosa showing a polypoid hyperplasia on an inflammatory basis. There is no evidence of any tumor."

The boy has remained in good health and has gained considerably in height and weight during the past two years. There has been slight edema of the upper eyelid and the tissues near the operative scar on one or two occasions when he has had an acute rhinitis but this has not occurred within the past year.

At the last examination in September 1944 there were no symptoms or signs of recurrence of the tumor which I believe supports the conclusion that the tumor was not malignant. This patient's history seems to bear out the opinion that this neoplasm was slow growing

and that it attained its final size only after several years of development.

In discussing the origin of fibromas Ewing[1] states:

"The exact point of origin of most fibromas is still undetermined. That many of them arise from misplaced islands of tissue, according to Cohnheim's theory is very probable. Chiari observed a congenital polypoid fibroma at the perineal raphe and Ribert has seen a fibrolipoma in the same situation. . . . In the breast Williams found evidence that 14% of the adenofibromas of this organ arise from embryonal rests, and the frequent association of chondroma and osteoma with fibroma favors this view."

Ewing says also:

"For other fibromas one must apply the theory of local irritation and disturbance of nutrition as in keloid which commonly follows scarring; in papillary and adenofibromas of mucous membranes, which are associated with catarrhal inflammation; and in fibromas of periosteum and joint areas, which may follow repeated trauma."

Perhaps the fibroma in this patient can most logically be ascribed to irritation and interference with nutrition following an infective ethmoiditis although at operation no definite evidence of infective disease was found. On the other hand, I see no way to prove that this tumor did not arise from a misplaced island of tissue. In regard to the formation of bone Ewing says: "Osteoma occurs as an element in many other tumors where it appears as a result of secondary ossification of the connective tissue." This is an explanation for the relatively large amount of bone scattered through this fibroma.

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REFERENCE

1. Ewing, James: Neoplastic Diseases, 4th ed., Philadelphia, W. B. Saunders Company, 1940, p. 158.

Society Proceedings

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Meeting of Monday, February 5, 1945

THE PRESIDENT, DR. ELMER W. HAGENS, IN THE CHAIR

Clinical Significance of Hoarseness

LOUIS H. CLERF, M.D.

(Abstract)

Hoarseness, a symptom, is the result of interference with the normal phonatory function of the larynx. While changes in the voice may result from nasal obstruction, pharyngeal tumors, enlarged tonsils, adenoids and other pathologic conditions, these should not be designated as hoarseness. It is also important to bear in mind that correction of these will not alter voice changes due to laryngeal dysfunction. Approximation, tension and vibration of the vocal cords are necessary for normal phonation. Any lesion which interferes with one or more of these will produce the symptom, hoarseness.

While phonation is necessary to determine if hoarseness is present, the cause can be determined only by adequate examinations which include the larynx. Since many diseases of the larynx are local manifestations of systemic or environmental conditions and others part of a systemic disease, the need for careful study is apparent.

Examination of the upper air and food passages should be considered as a routine part of the examination. This includes palpation of the neck. Mirror laryngoscopy, a procedure which should be practiced by all who treat patients suffering with hoarseness, is important and usually gives more information than does direct laryngoscopy. Failure to secure a satisfactory view of the larynx may be due to one of many causes. Among these are lack of experience of the examiner, inadequate instrumentarium, lack of cooperation of the patient, improper position and certain anatomic conformations, notably an overhanging epiglottis. The chronic smoker is a difficult subject for ex-

amination and it may be necessary to employ a local anesthetic. After examination of the upper air and food passages one then can determine the need for roentgen studies of the chest and neck, serologic studies and other systemic examinations.

Since a majority of laryngeal lesions producing hoarseness, excluding acute and chronic laryngitis, involve the anterior half of a vocal cord, it is imperative that the anterior commissure be examined before arriving at final conclusions. The most common group of lesions met with in my experience are the small, discrete, sessile or pedunculated elevations which are usually unilateral, occur at the junction of the middle and anterior thirds and are variously described as fibroma, fibro-angioma, vocal nodule, polyp and angioma. Practically all of these have a common origin, namely, improper or excessive use or abuse of the larynx. As a rule there is little difficulty in diagnosis. While satisfactory results can be secured by vocal rest in cases of small vocal nodules, in a majority of these it is necessary to remove the tumor mass and continue the patient on vocal rest for an adequate period. It has been my practice to have all these patients discontinue smoking for a prolonged period of time.

In case of chronic hyperplastic laryngitis the changes often resemble an enormous sessile polyp involving the entire length of the membranous cord, and these present similar problems in therapy. The best results are secured by removing all the redundant tissue by a stripping method and continuing the patient on vocal rest for a sufficient time.

Contact ulcer is an extremely difficult lesion to treat. While the diagnosis usually is not difficult particularly if the ulcers are bilateral, in the unilateral case one must think of carcinoma, syphilis and tuberculosis. I have a number of these patients who are definitely allergic and have not responded well to treatment. Scalping off the excessive granulation tissue and the ulcer usually is not followed by healing. A perichondritis of the vocal process of the arytenoid very probably is responsible for the long persistence of symptoms in some cases. There apparently are other factors, notably emotional, which are contributory. As a rule one does not wish to do a laryngofissure to approach the vocal process and unless one is familiar with suspension laryngoscopy, it is difficult to be certain that all the necrotic cartilage has been removed.

While the causes of paralysis of a recurrent nerve are numerous, the common causes are injury to a nerve, usually surgical, neoplasms of the thyroid gland, esophagus, trachea and upper mediastinum, and an undiagnosable group, the latter constituting from 15 to 20 per cent

of all cases. There appears to be considerable confusion, particularly among suregons, concerning the effects of unilateral paralysis of a vocal cord. It is not unusual to find unilateral paralysis following thyroidectomy with a normal voice so far as phonation is concerned. It is only when these patients attempt to sing that disturbances are noted. While one should distinguish between ankylosis of the crico-arytenoid joint and paralysis, the diagnosis of paralysis is simple. It is more difficult, however, to determine the cause of the paralysis. I have observed cases of unilateral paralysis with loss of tension coming on during a so-called grippe infection which ultimately cleared up spontaneously.

In bilateral paralysis of traumatic origin, the usual deformity is adduction of both cords with marked encroachment on the glottic chink, producing dyspnea but with slight voice disturbances. It is unsafe to defer tracheotomy if the patient has dyspnea or has choking attacks while swallowing. Before contemplating some surgical procedure to increase the size of the glottis it is well to wait three or four months, as unilateral recovery has occurred in a certain proportion of these cases. If, however, after a reasonable delay there is no recurrence of function, then either mobilization with lateral fixation of an arytenoid or arytenoidectomy is indicated. The results in these are uniformly good.

Among benign neoplasms recurrent papilloma is the most common and undoubtedly the most troublesome. In adults one must be on the alert, for cancer occasionally develops. Whether this is a distinct, independent process cannot be determined.

In children tracheotomy should be done if there is dyspnea, since the papilloma usually recurs quite rapidly and with a small glottic chink, delay is hazardous. In adults tracheotomy is not commonly required.

Many plans of therapy have been advocated but in my experience none give consistently good results. Estrogenic substances have been given a trial without, in my opinion, any remarkable benefit. I, therefore, am still removing papillomata by noncutting forceps with the hope and expectation that they will ultimately cease to recur and that there will be left behind a normal larynx. Good results have been reported by diathermy. Care must be taken in its use to prevent permanent injury to the larynx.

The most important and most interesting disease of the larynx is carcinoma. There are some who believe in precancerous lesions. If there are precancerous lesions, probably hyperkeratosis of

the larynx would conform, for it exhibits extensive proliferation of surface epithelium without, however, any tendency toward infiltration. A large number of these cases are now being seen. The cause is not apparent. Many are localized, appearing as well-circumscribed areas on the surface of one or both cords, usually anteriorly. In another group the keratosis is very extensive, involving the edge and upper surface of both vocal cords, even extending subglottically. There commonly is a history of excessive smoking in these cases but abstinence from smoking even for long periods of time seems to exert very little beneficial effect in therapy. It is possible that there may be a food deficiency factor, although correction of this usually is not followed by improvement. These patients should be kept under close observation, for in a certain number carcinoma does occur, whether it be a part of the keratosis or not. In others, removal of the keratotic material with cupped forceps often results in complete recovery.

Carcinoma of the larynx seems to be on the increase. With all the propaganda that is being exerted on the subject of cancer I question whether the diagnosis is made any earlier now than it was two decades ago. There are still many patients coming in with advanced cancer which had been treated for long periods as chronic hoarseness or chronic laryngitis. As in cancer elsewhere, it is necessary to think of cancer as a diagnostic possibility and also to look for it. Because of the serious nature of the disease it is imperative that adequate studies be carried out on every patient with laryngeal disease in whom cancer is suspected. This includes biopsy. No harm can result from a properly taken biopsy. It is, of course, important in this connection to emphasize the need of performing careful biopsies for a negative biopsy has never ruled out cancer in the patient. It merely signifies that the specimen submitted contained no cancer cells. If the clinical diagnosis suggests cancer and the biopsy is negative, the obvious thing is to repeat the biopsy until one is satisfied that the patient either has or does not have cancer. In spite of all the advances that have been made in cancer research and in the use of irradiation we have not progressed far in the field of therapy.

It is important that in discussing therapy one should never consider surgery versus irradiation or other plans of treatment, but surgery, irradiation and other plans of treatment versus carcinoma. One must, however, evaluate the various plans of therapy on the basis of effectiveness and, when so doing, one must be scientifically honest. Statistics can be distorted to prove or disprove anything. In evaluating end results in carcinoma diagnosis must be based on microscopic study of the tumor, not on clinical observations. One should have

the opinion of a competent laryngologist. I am not willing to accept the opinion of the radiologist who has turned laryngologist in order to evaluate the results secured by his own plan of therapy. I would not wish him to accept my opinion as to dosage, filtration or other technical requirements needed in irradiation therapy.

On the basis of observations made on patients treated by irradiation I still believe that surgical treatment offers infinitely more to the patient with laryngeal cancer. In the small, well-localized lesions involving a vocal cord at the junction of the middle and anterior thirds without subglottic extension or involvement of the anterior commissure, laryngofissure will give as high as 90 to 95 per cent of nonrecurrence in five years. In my series of laryngofissures, now more than 150 cases including many patients with subglottic growths, anterior commissure lesions and others in which the tip of the vocal process was involved, I have been able to secure a nonrecurrence rate of 79 per cent after five years. In the laryngectomized group one must, of course, consider the patient in whom the growth still is confined to the larynx, and these must be further subdivided into the cord lesions, subglottic lesions and epiglottic lesions. The subglottic lesions give the worst prognosis. In extrinsic cases or in those in whom there is metastasis one can hope for little, but I still believe that my group of five-year cures without recurrence following laryngectomy and block dissection of the neck followed by irradiation shows a better result than the group on which irradiation only has been carried out.

DISCUSSION

DR. DANELY P. SLAUGHTER: The part of Dr. Clerf's paper I am qualified to discuss is that on cancer of the larynx. I should like to emphasize with him that biopsy is the only positive way to make a diagnosis, and this should be done in all suspicious cases. Unfortunately, even specialists sometimes treat these patients for other conditions on a clinical diagnosis. In a large charity clinic, we see too many patients with late cancer of the larynx who have been treated for a long time on a clinical diagnosis of some other lesion and by the time biopsy is done the diagnosis may be established too late. The pathologist is not infallible but his diagnosis is certainly better than a clinical impression and it is worth while to repeat a biopsy several times if there is any doubt about the presence of cancer, because cancer is a 100 per cent fatal disease if not treated.

The treatment of these patients is still in a state of indecision. Surgery will cure any cancer of the larynx that irradiation will cure,

and many that irradiation will not cure. There is no one perfect technic as yet, but the percentage of cures with irradiation is low enough in comparison with surgery that there would seem to be no question as to which is preferable. On the other hand, there is no question that irradiation methods will cure a certain percentage of patients. The problem always comes up of what we should advise the patient; whether we should tell him that there are two methods of treatment—surgery with removal of the larynx, or irradiation, I do not know. I think it is up to us to make the decision for him. None of us like to remove the larynx and leave the patient without a voice, but when we see the results of irradiation, we feel we are justified in advising surgery in the majority of instances. Those of us who have seen results from both irradiation and surgery have a much better idea of the difficulties experienced by the patient treated by irradiation. It seems to me that radiologists tend to minimize these problems and do not report the radionecrosis, the deaths from aspiration pneumonia, the acute edema, and the recurrences, but those of us who work in a tumor clinic see them day in and day out.

There have been several methods described by which one can select the cancer which will be radio-curable. The pathologists say the more highly undifferentiated lesions are most sensitive. The radiologists say the early lesions confined to one cord in which there is still mobility of the cord are radio-curable. So far as I know, there is no one yet who can look at a given cancer case and say whether or not it is curable by radiation. Of course, no one can say that the same case is curable by surgery from the standpoint of lateral neck metastases, but at least with surgery there is no larynx for the tumor to recur in.

As to statistics of end results, three-year cures are not valid. I do not think anyone accepts these figures as being of serious importance so far as cure of cancer is concerned. Five years is the minimum time limit and it is beginning to be realized that this should be extended to ten to fifteen years. I agree with Dr. Clerf that statistics are tricky; nevertheless, in analyzing a large series of cases, statistical analysis is the only way we can arrive at an evaluation. I know of no one who has alternated cases without selection in a large series, taking them as they come and treating every other one by surgery or irradiation. I think we might produce more complete information if this were done. At one of the large cancer hospitals in New York City, they have practically given up irradiation of operable laryngeal cancer; they have had so many failures, so many difficulties, that they advise laryngectomy.

Dr. Clerf's results with laryngofissure are remarkable. Where the indications for this operation are confined within strict limits, it certainly is the treatment of choice. I think it has fallen into disrepute in some quarters because we have tried to make it do too much. As to lateral neck metastases, they are for all practical purposes incurable by irradiation. Squamous carcinoma in neck nodes from any source should not be a radiation problem. Radical neck dissection when the nodes are operable is the treatment of choice and will give a fairly good five-year cure rate. I do not think we should consider the presence of early neck node metastases as a contraindication for surgery in a new case. In considering a new patient, if the primary lesion is operable, there is no reason that laryngectomy cannot be combined with radical dissection, or neck dissection done soon after the larynx is removed, and this has been done in several cases. If the lesion crosses the midline, the patient may have bilateral neck metastases. I think in these cases bilateral neck dissection should be done if the nodes are operable, as the disease is always fatal and we are justified in going to considerable lengths to obliterate it.

Dr. Paul Holinger: We are to be congratulated on having Dr. Clerf give us this outstanding presentation. We have a peculiar position either to deny or to defend, depending on how we look at his remarks, and I think discussion gives us an opportunity to do either. First, I should like to ask about the treatment of chronic laryngitis; some of us see cases of chronic laryngitis which persist and remain simple chronic laryngitis after tuberculosis and syphilis and cancer have been eliminated by all significant tests. Too often, of course, chronic laryngitis is in reality carcinoma, but we still see a few cases of true chronic laryngitis.

Another problem Dr. Clerf mentioned is that of hyperkeratosis and leukoplakia; they are not the same. I wish he would say more of treatment other than scraping the tissue. When does it turn into cancer and when does he do a laryngofissure or a laryngectomy? This question is prompted by one patient with such a proliferation of tissue that a laryngofissure became necessary because it was impossible to remove the tissue adequately by endoscopic means. The histologic examination demonstrated the presence of a low-grade carcinoma deep within the cord.

On the question of surgery versus irradiation for treatment of carcinoma of the larynx, I agree fully with Dr. Clerf and Dr. Slaughter that treatment should be evaluated on the basis of the patient versus his cancer, not on the basis of one type of treatment versus another. But with irradiation therapy being so blatantly expounded in

the lay press as superior to surgery, even to the point of eliminating surgery because of the supposedly better functional result with irradiation, we must re-analyze some of the factors of surgery versus irradiation in the light of recent experience.

Accuracy of diagnosis is the first point. I know of no laryngofissure or laryngectomy done without a positive biopsy. Yet at Research and Educational Hospital we have had two patients on Dr. Lederer's service who have died of tuberculosis following treatment by a famous group of tumor specialists for a supposed carcinoma of the larynx. No biopsy had been done. I believe Dr. Galloway has had a similar experience at County Hospital. In another instance, a patient was referred to St. Luke's Hospital for biopsy by his nephew, a physician; irradiation had been started by the same group for a supposedly obvious laryngeal carcinoma without a biopsy having been done. Biopsy proved the tumor to be a papilloma. Certainly, if based on statistics of such cases the cure rate of cancer by irradiation would be high.

Another point of importance is that if a patient who has had irradiation for treatment of an operable cancer of the larynx should develop recurrence, it is difficult to know the extent of the recurring lesion. One can see the obvious recurrence locally; it would be easy to say it should then be removed surgically since it failed to respond to irradiation. But in removing what appears to be the tumor one finds it has extended much further than was anticipated by its gross appearance, once this appearance has been changed by irradiation therapy. Finally, if, as both Dr. Clerf and Dr. Slaughter said, the curability of cancer is so much greater in both early and moderately advanced lesions by surgery than by irradiation, by all means let us fight this ability of irradiation to take patients away from surgery through erroneous data.

DR. L. B. BERNHEIMER: I have seen a number of patients with carcinoma of the larynx treated by irradiation. The diagnosis of carcinoma was made only after examination of biopsy specimens and the indications for irradiation were controlled by the following criteria: (1) Noninfiltrating neoplasms with freely movable laryngeal structures were considered good candidates for irradiation therapy. (2) Highly anaplastic lesions were sometimes considered biologically inoperable, and even though fixation was present, were therefore irradiated. (3) Postoperative recurrent laryngeal carcinoma was treated by x-ray but the end results were usually bad. (4) Carcinoma of the larynx in individuals who had some systemic contraindication to surgery was treated by irradiation.

The end results in the early noninfiltrating lesions so treated were excellent and I believe they will be found to compare favorably with the results obtained by laryngofissure. If an opinion is sought regarding the relative merits of irradiation and surgery, it is through treatment of such early lesions that such an opinion must be based. Extensive infiltrating neoplasms with cervical metastases do not respond to irradiation and the honest radiologist will frankly state that he cannot cure such lesions but can offer only palliative treatment. He will also frankly state that any lesion that shows evidence of infiltration will respond much better to surgery than it will to irradiation.

The therapeutic test is not a test to see whether the neoplasm disappears, but whether motility may be restored in a fixed lesion by exposure with a relatively small amount of x-ray. If motility is restored, the interpretation is that fixation is due to inflammation and not to the neoplasm and that therefore the lesion is noninfiltrating and favorable for irradiation therapy.

I have performed laryngectomy on a number of patients who, in spite of adequate irradiation, showed persistent or recurrent disease. The dissection of such larynges was more difficult because of increased bleeding and scar formation and healing was delayed. The postoperative use of penicillin, however, has been extremely helpful in the healing of such wounds.

It is my opinion that there is a definite place for honest irradiation in treatment of carcinoma of the larynx. Surgery can do many things that irradiation cannot do, as well as everything that irradiation can do, but there is room for both in the treatment of this disease. The indications for irradiation are definite and if when these indications are present adequate x-ray therapy is used, good results will be obtained.

DR. THOMAS C. GALLOWAY: We have gone through several phases in the treatment of cancer of the larynx at County Hospital. There was a time when we thought everything should be operated on, then there was a time when we swung rather strongly to irradiation; and we used it in some rather early intrinsic cancers. I have come back to the point where I think if operation offers any particular hope it should be done, except when it is contraindicated by the patient's general condition. What I tell patients now is that the best figures on irradiation are those of about 28 per cent of five-year arrest reported by Coutard in 1931, and that afterward he had to report that about one-third of the arrested cases got recurrences in the sixth and seventh years. I tell patients that Clerf and Jackson and others, by

operation in suitable cases, get 80 to 90 per cent cures that leave the patient with a normal airway and a usable voice. I tell them also that no one is justified in making them believe that irradiation is without discomfort or danger or that it can give them nearly 100 per cent chance of cure. The County Hospital is the final repository of failures and there I have seen three patients die within six months of the time they had been demonstrated in a certain clinic as cured. It seems to me there has been some harmful exploitation of the claims for irradiation in the larynx, although I give it great credit in treatment of many other tumors about the head. It is true that the radiotherapist cannot do much for advanced cases.

DR. LOUIS H. CLERF (closing): I am very grateful to the discussors for their consideration. I did not discuss chronic laryngitis because of lack of time. It is an important entity and often is extremely difficult to treat. The history of these patients is important. A careful study of the patient's habits, working conditions, home environment, dietetic, drinking and smoking habits and basal metabolic rate, among other investigations, will often give a clue concerning the etiology as well as the treatment. I recall the case of a man whose work required him to go into a "cold room" many times. This sudden change in temperature from a warm to a cold atmosphere unquestionably proved to be the cause, for when his work was changed the laryngitis cleared up. In another patient infection of the upper food passages was unquestionably a factor, for following tonsillectomy his laryngitis cleared up promptly.

The treatment of keratosis is difficult. In the localized lesion removal with cupped forceps may be all that is required. In the diffusely distributed lesion removal presents a problem. It is imperative, however, that these patients be kept under observation for in a certain proportion carcinoma develops.

Dr. Bernheimer spoke of grading tumors. We have discontinued this because the pathologist does not believe it of any particular value and in our experience recurrences have not been dependent on the degree of malignancy of the tumor, at least so far as we could determine. Too often, also, sections made from different portions of the same tumor do not exhibit the same degree of malignancy and, further, pathologists vary remarkably in their interpretation of degrees of malignancy.

In the larynx, cordal tumors are commonly Grades II or III with a few instances of Grade I. Tumors of the ventricular band and the arytenoid, also pharyngeal tumors, are often anaplastic.

Irrigation of Maxillary Sinus by Way of Middle Meatus

O. E. VAN ALYEA, M.D.

(This paper appeared in full in the June issue, p. 298.)

DISCUSSION

DR. ROBERT FRASER: I enjoyed this presentation very much and am grateful to Dr. Van Alyea, just as I have gained progress through his earlier work. In the smaller city one is required to irrigate the maxillary sinus in a higher percentage of upper respiratory infections. The patient is perhaps seen earlier and more frequently, and reviles one more roundly for each day of prolonged pain or disability from a suppurative maxillary sinusitis. Also, the anesthesia used for the procedure had better be effective.

This paper of Dr. Van Alyea's has the purpose of making the middle meatus routine more rational and familiar. I should like to mention some minor points in anesthesia, instrumentation and recording. Dr. Edward King showed me his Wocher-made cannula in 1924. His children's size, valuable in adult use, is similar to Dr. Van Alyea's No. I, but more slender; the opening is farther from the tip, and it is very stiff in consideration of its diameter. One may feel sure of penetration and the return flow is more ample than with larger instruments. We give the patient 30 mg. of sodium pentobarbital, and use about 10 mg. of cocaine paste on a slender S-shaped copper applicator, 10 cm. in length. This is made by tapering a No. 12 copper wire with nitric acid dipping, and is kept from falling by a 3 mm. strip of adhesive tape attached to the opposite malar bone; it is inserted in a second.

For the local topography on the lateral wall posterior to the uncinate, the point of entry may be recorded as FPT (first point touched) or as one of nine possible positions, namely, 1, 2, 3, (backward) and high, medium low. This becomes a great help in probing for the same place again.

Should polyps or turgidity obstruct, oil is injected first, which promotes return flow and safety. One feels justified in going in early enough and often enough to get ahead of granular disintegration and digestion of the exudate.

DR. ALFRED LEWY: So far as I can remember, in Chicago, the maxillary sinus was first washed out through the natural ostium by Norval Pierce, from whom several of us, then young men, learned the

technic. I have been doing it ever since with, I believe, excellent results and few mishaps. I think Dr. Van Alyea's description of his technic is about as good as anyone can make it, but it must be learned by doing it. It is best done by touch, and difficult to explain. I cocainize the middle meatus with five per cent cocaine without any preparatory treatment. If I fail to find the natural opening, I use Ruskin's curved needle, introduced with the point down, and when I think I am far enough back to be in contact with the membranous portion I turn the point downward and outward. I made my first essay with Dr. Van Alyea's cannula, but the patient got a pain in the eye and I desisted. I have also had the experience of entering the orbit in entering the sinus with a dull cannula. I have a shorter instrument for use in children, and I think it well to use that if there is trouble pushing aside the turbinate bone. Anatomists consider that in only about 20 to 25 per cent of cases is the natural opening available. However, they are dealing with tissues made rigid by preservatives. Clinically, I should say it is available in 80 to 85 per cent. In the living the turbinates are more or less flexible. I think it is a mistake to irrigate an antrum more than once a week in subacute cases.

DR. THOMAS C. GALLOWAY: I would like to ask Dr. Van Alyea whether he uses the Yankauer sharp cannula, and how frequently he irrigates the sinus.

DR. O. E. VAN ALYEA (closing): I recall that when I read the first paper on this subject, in 1936, Dr. Galloway asked if I used the Yankauer cannula, and the answer was "No" then and still is. I think that whatever instrument you are accustomed to or prefer is the one to stick to. Goodyear uses one similar to the cannula I use for the frontal sinus; it is a little thinner. He says it must be that shape and size. The ones I use I like, and if I did not I would change them. I think the sharp-pointed instrument should be thin, one that will not cause a wide break which may result in a permanent opening.

I have definite ideas as to the frequency of irrigation; I feel that overirrigation is a tremendous mistake. Infections can be kept going by irrigating the sinus too often, and you may not know this until the patient is not available for irrigation and seems to be better when you do see him again; then you realize you have been overdoing it. One should not depend solely on irrigation, especially in chronic cases one is trying to clear up without surgery. Something should be done in addition to removing the exudate. An effort should be made to find what is keeping the sinus in that state and remove the cause of infection as well as establish drainage. This may require a thorough

study on a systemic basis, including an allergic survey; it may also require an occasional x-ray check-up with oil instilled in the cavities. Many cases are not hopeless if you have enough persistence and enough cooperation from the patient to make a good study.

Penicillin is effective in chronic cases, according to Crowe. I have not used it sufficiently to say if it is of any benefit applied locally in the sinuses.

Meeting of Monday, March 5, 1945

THE PRESIDENT, DR. ELMER W. HAGENS, IN THE CHAIR

Visualization of Otitic Brain Abscess

EDWIN J. BLONDER, M.D.

(Abstract)

Visualization of a chronic otitic brain abscess by a substance roentgenologically opaque may be extremely valuable in determining the extent of the abscess, or may also be instructive in observing the progress of such an abscess under management. Lipiodol was instilled in a patient with a chronic temporosphenoidal abscess cavity with excellent results.

The patient was a man aged 37 who had bilateral chronic suppurative otitis media for at least 25 years; he had become totally deaf. A right peripheral facial paralysis came on suddenly five years prior to his entrance to the Illinois Eye and Ear Infirmary. The facial paralysis was unimproved. The patient complained of very severe right temporal headache, not improved by medication. The right ear canal was dry. Most of the drum was destroyed. The promontory was covered with scar tissue and small, moist granulations. The left ear canal was moist; the drum was destroyed, and moist granulations and scar tissue covered the promontory. General physical and neurologic examination was otherwise negative. Visual fields and fundi were negative. No nystagmus was observed. The caloric test elicited a normal response with both ears. Laboratory tests, including Wassermann and spinal puncture, were within normal limits. The x-ray report "is suggestive of an inflammatory change in both

Fig. 1.

mastoids, with pronounced reactionary bone sclerosis and possible cholesteatoma on the left side; a pronounced degree of low grade bone destruction throughout."

Because of the history, a right radical mastoidectomy was performed. Soft, necrotic material was present about the antrum while the remainder of the mastoid was largely sclerotic. As the attic was cleared of granulations, it became evident that the tegmen was necrotic, and as more necrotic bone and tissue was removed, there was a sudden gush of brown liquefied pus. Gauze was inserted in the abscess opening so that the pus would not be evacuated too rapidly, to reduce the danger of secondary edema of the brain tissue. The wound was packed open and sulfathiazole therapy was instituted. The contents of the brain abscess were found sterile on culture.

One week later the wound was reopened without anesthesia. The gauze pack was removed and some pus was evacuated. A soft probe inserted in the abscess revealed that the cavity was large with a firm capsule. About three-fourths ounce of lipiodol was inserted into the abscess cavity by means of a syringe and a eustachian catheter. This

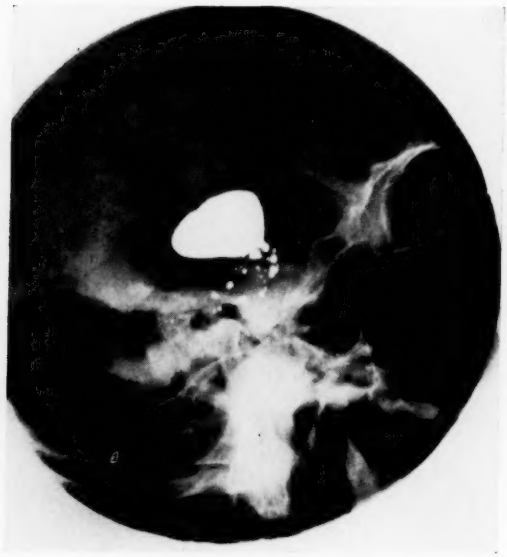


Fig. 2.

was done on a cart in the operating room and the patient was taken immediately for x-ray plates. Two views were taken, a lateral and an anteroposterior (Figs. 1 and 2). The results were beautiful, showing the abscess cavity well filled. The lipiodol was completely evacuated in one week. A soft, large rubber tube was inserted in the cavity immediately after the first series of plates, and subsequent x-rays were taken at weekly intervals with the tube in place.

The patient's headache was relieved immediately after the operation and has not returned to date (two years later). The subsequent course was uneventful and he was discharged 44 days following operation. On March 1, 1945, a complete examination showed the ears to be dry, with no neurologic or ophthalmologic findings except for the peripheral facial paralysis and deafness. He is a good lip reader and is able to work every day.

Carcinoma of the Sphenoid Sinus

CARL CHRISTOPH, M.D.

(Abstract)

Carcinoma of the sphenoid sinus is a relatively rare condition. According to Salinger only 40 cases of malignant growths of the sphenoid sinus have been reported in the literature up to 1939. However, carcinoma of this type is usually diagnosed so late that it is difficult to determine exactly where the neoplasm arose.

This patient, V. D., a man aged 32, was seen first on March 8, 1943, with bleeding from the right side of the nose for the past two months. He complained of severe vortex headaches and diplopia which increased on looking to the right.

Examination showed the septum deviated to the right, with a spur on the left side; the tonsils were absent. Vision was 20/25 for the right eye; 20/20 for the left. A paralysis of the right external rectus muscle was found. The visual fields showed a triangular defect in the upper right temporal quadrant; the left field was normal. Postnasal examination showed a tumor mass growing out of the right sphenoid, and the x-ray plates showed that the entire right sphenoid sinus was filled by the mass.

The blood examination showed hemoglobin, 60%; red blood count, 3,340,000; color index, 0.9. The white count was normal. The report on a frozen section taken from the tumor mass showed it to be a malignancy. The sinus was cleaned out as thoroughly as possible, since there was a rather severe hemorrhage. Four radium needles were inserted, 10 mg. each, for ten hours, and on the following day deep x-ray therapy was instituted, as follows:

10 treatments of 250 R units to both right and left sides,

Skin distance:	70 centimeters
Field:	10 x 15 centimeters
Voltage:	800,000 kilovolts
Milliamperes:	10
Lead	1.0
Tin	1.56
Copper	3.62
Aluminum	3.0

Following the course of x-ray treatments, iron and arsenic injections were given, and after 12 of these the hemoglobin rose to 90%, and the red blood count to 4,400,000.

The final microscopic diagnosis was moderately rapidly growing, poorly differentiated squamous cell carcinoma (Grade III) invading vascularized fibrous tissue; multiple polyps, glandular and fibrous, with chronic inflammation.

The patient's headaches disappeared after the fourth or fifth x-ray treatment. The diplopia was not quite so apparent, although it is still present when he looks to the extreme right. The patient has been under observation for two years since operation, and there has been no evidence of recurrence.

DISCUSSION

DR. ALFRED LEWY: I wonder if Dr. Christoph would give a more detailed description of the appearance of this mass with the nasal mirror and the nasopharyngoscope.

DR. SAMUEL SALINGER: The mass described by Dr. Christoph seemed to be fairly well isolated. I would like to ask from what portion of the sphenoid sinus it was removed, and whether the entire sphenoid had to be exenterated; also whether it was palpable. I am reminded of a case that did not have so fortunate a termination as Dr. Christoph's. This woman had been suffering from intractable headaches and revealed a complete ophthalmoplegia and proptosis when I first saw her. I suspected a lesion of the brain and the orbit, and on nasal examination obtained a little bleeding on palpating the superior meatus with a probe. With the idea of biopsy examination I eventually cleaned out an enormous amount of tissue from the posterior ethmoid and sphenoid and came up against a blank wall which proved to be the posterior wall of the sphenoid. She received a large amount of irradiation which yielded an excellent primary result but failed to cure the patient since the lesion had already invaded the orbit and crossed the chiasm. A study of this type of case reveals the fact that a malignant tumor originating within the sphenoid cavity can grow and erode the walls before there are any marked or characteristic symptoms. Dr. Christoph's case is interesting because it originated in a location where its spread produced bleeding which led to the examination and diagnosis.

DR. GEORGE WOODRUFF: I should like to ask about the subjective symptoms of pain and headache.

DR. CARL H. CHRISTOPH (closing): In reply to Dr. Lewy, on postnasal examination there was a bleeding mass that came from the sphenoid sinus and extended into the nasopharynx. It was impossible to tell whether the posterior wall of the sphenoid had been reached because of the excessive bleeding. The anterior wall had already been destroyed by the tumor. The x-ray plates showed the entire sphenoid sinus to be filled with a tumor mass.

So far as symptoms were concerned the patient had, in addition to headaches, diplopia and bleeding, difficulty in breathing.

About fifteen years ago I reported a case of osteoma of the sphenoid before this Society; this patient had identical symptoms. The only differential point in this case would be a tumor of Rathke's pouch. However, I do not believe that this tumor originated there.

Temporal Lobe Syndrome Following Mastoidectomy

ALFRED LEWY, M.D.

(Abstract)

W. J., a negro boy aged 12, was seen at the Illinois Eye and Ear Infirmary on September 12, 1940, complaining of a discharging ear since the age of four, which his mother thought followed an attack of scarlet fever. The boy, who was in the fourth grade in school, appeared dull, undernourished and anemic.

On examination the right drum membrane appeared normal; in the left ear, the membrana tympani was absent, a polypoid mass was seen in the canal and there was a profuse, foul discharge. The nose was filled with a profuse, mucopurulent discharge. The teeth were excellent, the mucosa of the mouth was pale. The tonsils were enlarged and infected; a large amount of adenoid tissue was present, and there was profuse postnasal discharge. A diagnosis of chronic suppurative otitis media was made, with chronic sinusitis, hypertrophied tonsils and adenoids. The x-ray examination confirmed the findings in the left ear: no normal cell structure, moderately dense sclerosis in the trianagle, mottled irregular density in the upper posterior region extending to the knee and over the sinus wall. Hearing was reduced in the left ear.

Following tonsillectomy and adenoidectomy and removal of the aural polyp, the patient was kept under treatment for several months,

during which time the aural discharge diminished and became less foul. He contracted an upper respiratory infection in January and did not return to the clinic until March 7, 1941. The history was that on February 2 he suffered a "lightning stroke" of the left side of the face, which gradually subsided. On February 10 he developed measles and the aural discharge increased. On March 2 he developed headache followed by deep orbital pain on the left side; four days later backache and stiffness of the neck appeared, with difficulty in walking and sitting.

On examination he appeared acutely ill and stuporous, responding rationally to persistent questioning. The left pupil was much larger than the right; both reacted sluggishly to light and accommodation, especially the right which was almost fixed. The nose was filled with mucopurulent discharge. There was slight asymmetry of the face on swallowing. There was a purulent foul discharge from the left ear; no mastoid tenderness or periosteal thickening. The neck was rigid and retracted; palpable cervical lymph nodes were present. The back was rigid, with slight opisthotonus. There were exaggerated breath sounds in the posterior bases of both lungs; a systolic murmur was noted in the second left interspace; not transmitted. The superficial reflexes were normal; the deep patellar reflexes were exaggerated; positive Kernig sign; Brudzinski sign present; Babinski sign absent.

The blood count showed hemoglobin, 81%; red blood count, 4,450,000; white blood count, 13,800; 80% polymorphonuclear leukocytes; 8% lymphocytes; 2% monocytes. The spinal fluid was under increased pressure and turbid, but there was no pellicle. The Wassermann test was 4+; the gold curve, negative. The cell count was 4,500, almost all polymorphonuclears; Pandy test 4+, total protein .99%, chloride 689 mg., sugar 52 mg.; Tobey-Ayer test negative. X-ray examination of the mastoids showed: right mixed cell type, normal density; the left triangle contracted with moderately forelying sinus wall. The center of the triangle contained an irregular area of poorly defined loss of bone structure. The antrum was markedly enlarged, consistent with the presence of cholesteatoma. The entire left petrous bone showed density increased with irregularities along the superior aspect medial to the arcuate eminence, suggesting chronic petrositis with recent activity.

At this time a diagnosis of septic otitic meningitis, acute exacerbation of left otitis media with mastoiditis, left facial paresis, subsiding post-measles sinusitis and petrositis was made. A left radical mastoidectomy was performed by the postauricular route. The cor-

tex was necrosed; the mastoid cells, completely broken down. A large dehiscence 1 x 1.5 cm. was found in the center of the tegmen of the middle fossa. The dura was thick, gray, covered with spongy granulations; it was widely exposed and found pulsating and normal in color except for the area of dehiscence. The antrum was enormously enlarged, filled with cholesteatoma which on removal disclosed a pool of foul, greenish pus, necrosed bone and a granulomatous mass within the middle ear. No ossicles were found, but a large dehiscence over the facial nerve in the middle ear portion; touching this produced facial twiching. The peritubal cells were necrosed and contained frank pus. No other leads to the apex and no fistula could be located. The mass over the facial nerve was left in situ, the canal and the mastoid cavity were loosely packed with vaseline gauze and the posterior wound was partly sutured.

While awaiting the report on the culture sulfanilamide was administered. On the afternoon of the first postoperative day, complete facial paralysis was present on the left, with motor aphasia, complete flaccid paralysis of the right arm and aspastic paralysis of the right leg. The right patellar reflex was exaggerated, the left absent; right abdominal and cremasteric reflexes were absent. The Babinski sign was positive on the right; the tongue deviated to the right. The left pupil was fixed; the disks were normal. The patient became completely stuporous and unable to swallow.

It was felt that an encephalitis or thrombosis of the small venules of the left temporal lobe was present. Culture of the secretions from the mastoid disclosed pneumococci among other organisms. Sulfapyridine was administered intravenously, and orally when the patient improved sufficiently to swallow. After the third postoperative day there was continuous improvement in the paralysis but the aphasia persisted; he could neither talk nor swallow. On the fourth day he became rational and alert and began to use the right arm and leg. The right facial reflexes reappeared on the sixth day, the paralysis began to decrease and he made attempts to speak.

The hospital records indicate that the aphasia was due to edema or localized cerebritis and not to an abscess. The mouse inoculation test from the mastoid smear showed pure pneumococci, Type III. A week later, Dr. Boshes, the consulting neurologist, found no meningeal signs, moderate weakness of the right side of the palate, tongue and face and a change from aphasia to dysarthria.

The patient was discharged on April 6, in excellent physical condition. The mastoid wound was healed and the external canal was

dry; the hearing showed a remarkable improvement. He had gained ten pounds and looked well, although there were still some neurologic findings, and dysarthria.

The patient is still under observation and continues to improve. There is a great change for the better in appearance, personality and mental alertness; he is attending a speech school and doing well. The question of latent abscess has been considered but there are no indications at present that there is such a lesion.

DISCUSSION

DR. ELMER HAGENS: Would you briefly review the syndrome as you saw it?

DR. ALFRED LEWY (closing): About one day after the operation this boy developed slight right facial paralysis, complete paralysis of the arm and leg on the right side, and complete aphasia. It was difficult to determine the extent of the aphasia, because he came in with manifest meningitis; he was practically stuporous. His mind cleared very rapidly, and that is why I hestitated to do any exploration of the brain. I am glad I did not, since this was not a definite abscess formation but merely, I believe, thrombosis of the small venules of the temporal cortex. Dr. Boshes was inclined to believe that it was an abscess and that we would have to operate. These cases of temporal lobe syndrome, a considerable number of which have been reported, may be explained as thrombosis of the small venules of the temporal lobe cortex, or they may be a localized edema or inflammatory reaction that subsides without breaking down.

Ossifying Fibroma of the Ethmoid Cells and Frontal Sinus

GEORGE WOODRUFF, M.D.

(This paper appears in full on page 582.)

DISCUSSION

DR. M. F. SNITMAN: I have been rechecking the histologic slides of about 25 cases of sinus malignancies. The customary diagnosis has been squamous cell carcinoma, this term including also those specimens which were typically of the cylindrical cell type.

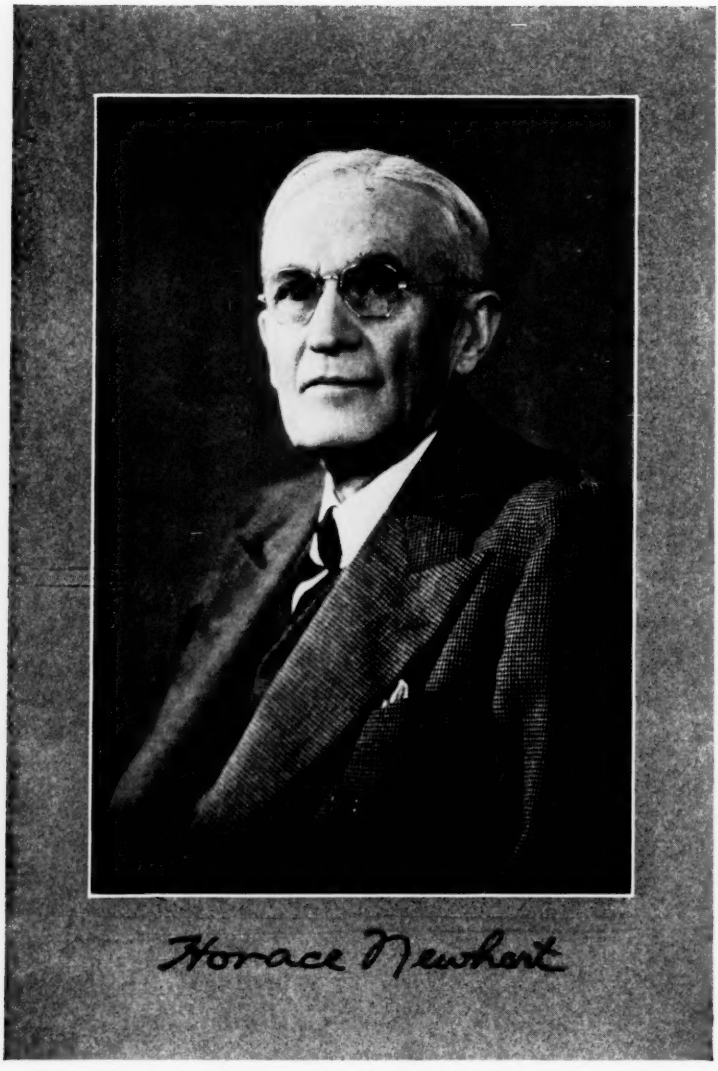
Evaluation of a therapeutic procedure requires a more exacting histologic terminology. In not a few cases, difficulty arises in the

differentiation between fibroma and fibrosarcoma. In one case of so-called fibrosarcoma of the antrum, the lesion was removed surgically and no recurrence has taken place after two and one-half years. Re-examination of the slide from this case permitted a histologic diagnosis of fibroma. There are, however, fibromas which are at the border line between benign and malignant, which fact accounts for the frequent discrepancy in the diagnoses submitted by several pathologists.

DR. SAMUEL SALINGER: In calling attention to the ossifying tendency in this tumor, I think one should remember that this is not a rare condition. There have been reports in the literature of bone fragments being found in sinuses and fibrotic tumors, even to the extent of forming perfect islands. Just what the determining factor is in this metaplasia is still unknown. This phase interests me more than the confusion about diagnosis. In the case just presented I think the original diagnosis of fibroma was justified, judging from the appearance of the patient and the slide.

DR. GEORGE WOODRUFF (closing): I am not an expert with the microscope, but I have seen enough specimens go to various pathologists, and good pathologists, to know there will often be diversity of opinion about the same specimen. It is very difficult to say with certainty just what is present in some of these tumors.

I believe Dr. Salinger misunderstood what was said concerning the pathologic diagnosis. The original opinion was osteosarcoma, and the final opinion was ossifying fibroma.



Horace Newhart

HORACE NEWHART, M.D.

1872-1945

Horace Newhart, Emeritus Professor of Otolaryngology at the University of Minnesota, died in Minneapolis on July 9, 1945, at the age of 72 years. He is survived by Mrs. Horace Newhart, a son, Elwood, and a daughter-in-law and their two children, and a sister. All live in Minneapolis.

Dr. Newhart was born in New Ulm, Minnesota, on December 9, 1872. He attended Carleton College from 1891 to 1893, then transferred to Dartmouth College, where his scholarship won for him a Phi Beta Kappa key and his A.B. degree in 1895. He then attended the University of Michigan Medical School and obtained his M.D. degree in 1898. Following his graduation from Michigan, he went to Vienna for further study and remained there through 1899. In 1900 he returned to Minneapolis and began a general practice although his special interest was ophthalmology and otolaryngology in which he had taken some courses while abroad After a couple of years of private practice an opportunity came to broaden his background by a position on the staff of the Jackson Sanitorium in Danville, New York. While there he met Anne Hendrick of Albany to whom he was married September 4, 1904.

Another trip to Vienna followed in 1905, and then he returned to Minneapolis to resume general practice. After a third visit to Vienna in 1908, Dr. Newhart limited his practice to ophthalmology and otolaryngology.

The year 1912 again found him studying in Europe. It was in that year that he was appointed to the staff of the Department of Ophthalmology and Otolaryngology at the University of Minnesota. His major interest developed in otolaryngology to which he gradually limited his work. Dr. Newhart became Professor of Otolaryngology and Director of the Division of Otolaryngology at Minnesota in 1930.

Dr. Newhart became a familiar figure in national otolaryngological circles where he was a tireless worker in the interest of problems related to the hard of hearing. He was elected to membership in the American Academy of Ophthalmology and Otolaryngology in 1905, to the American Laryngological Association in 1923, to the American Laryngological, Rhinological and Otological Society, Inc., in 1924, and

to the American Otological Society in 1926. His memberships also included the American Acoustical Society and the American Society for the Hard of Hearing. In several of these societies, he was honored by the presidency: the American Academy of Ophthalmology and Otolaryngology in 1924-45, the American Society for the Hard of Hearing in 1939, the American Otological Society in 1939.

Dr. Newhart was a pioneer in the promotion of periodic testing of the hearing of school children. He became consulting otologist for the Minneapolis Public Schools in 1925, a position which he held at the time of his death. He was closely identified with the activities of the Minneapolis Society for the Hard of Hearing in which he served as president from 1925-29. For a number of years he served as Chairman of a Committee on the Conservation of Hearing of the Minnesota Medical Association. As chairman of this group, he made repeated efforts to secure legislation to establish a state program for the detection and care of early hearing impairment, particularly in children. To date this work has not been rewarded but very likely a groundwork has been laid which will eventually be a monument to his efforts.

Dr. Newhart's hobby was his work. However, his social affiliations were numerous. He was a member of the Sigma Chi and Phi Rho Sigma fraternities, and of the Minneapolis, Minikahda, LaFayette and Campus Clubs of Minneapolis. His religious affiliation was Congregational.

Dr. Newhart's fellow practitioners will remember him as a kindly, patient physician who was always considerate of others' interests. One competitor once said of him, "he is always a gentleman." His many friends subscribed to this.

LAWRENCE R. BOIES.

PUBLICATIONS OF DR. HORACE NEWHART

1. The Responsibility of the Physician in Otology, Volta Review, April, 1921. Reprinted from Journal-Lancet 40:180-83 (April 1) 1920.

2. The Results of a Preliminary Survey of School Children by Audiometric Methods, Tr. Amer. Laryng., Rhin. and Otol. Soc., Inc., 1926.

3. Diagnostic School Clinic in the Public Schools as Factor in Conservation of Hearing, J. A. M. A. 87:1882-84 (Dec. 4) 1926.

4. Efforts Towards the Prevention of Deafness in School Children, Volta Review, Vol. 28, No. 9, Sept., 1926.

5. Conserving the Hearing of the School Child Through the Use of the Audiometer, Northwestern Health J., Vol. 12, No. 4, April, 1927.

6. Aids for the Hard of Hearing, Tr. Amer. Acad. Ophth. and Otolaryng., 1928; Laryngoscope, Vol. 34, No. 4, April, 1928.

7. Progress in the Prevention of Deafness, J. A. M. A. 93:1117-19 (Oct. 12) 1929.

8. A Teacher's Personal Health, Minnesota J. of Education, vol. 9, April, 1929.

9. Recent Efforts to Prevent Deafness Among School Children, Canadian M. J. 25:314-16, 1931.

10. Aids for the Hard of Hearing, Arch. Physical Therapy 13:202-206, 1932.

11. A new Audiogram Blank, Tr. Amer. Acad. Ophth. and Otolaryng., 1932, p. 496.

12. Report of the Committee on the Prevention and Amelioration of Deafness, Tr. Amer. Acad. Ophth. and Otolaryng., 1932, p. 532.

13. Modern Methods for Caring for the Deaf and Hard of Hearing, Minnesota Med 16:251, 1933.

14. Meningitis of Otogenous Origin with Recovery, Laryngoscope 43:516-17, 1933.

15. The Hard of Hearing School Teacher, Laryngoscope 43:986-90, 1933.

16. Indications for Operative Interference in Middle Ear Suppuration, Minnesota Med. 17:439 (Aug.) 1934.

17. Tonsillectomy in the Tuberculous: Incidence and Pathology of Tuberculosis of the Tonsils in Adults (with S. S. Cohen and C. C. Van Winkle), ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY 43:769-75 (Sept.) 1934.

18. Report of the Committee on Deafness Prevention and Amelioration of the American Academy of Ophthalmology and Otolaryngology, Tr. Amer. Acad. of Ophth. and Otolaryng., 1935, pp. 492-94.

19. Relations between Otologists, the Manufacturers of Hearing Aids and the Hard of Hearing, Tr. Amer. Soc. for the Hard of Hearing, June 26, 1935, pp. 16-19.

20. Acoustics as Related to Otology. Proceedings of the Minnesota Academy of Ophthalmology and Otolaryngology, Laryngoscope 46:310, 1936.

21. Performance Characteristics of Electrical Hearing Aids for the Deaf (with H. E. Hartig), Arch. Otolaryng. 23:617-32 (June) 1936; Minnesota Med. 19:413 (June) 1936.

22. Hearing Aids, in Hollender, A. R.: Physical Therapeutic Methods in Otolaryngology, St. Louis, C. V. Mosby Company, 1937, pp. 307-15.

23. Some Practical Applications of Acoustics in Medicine (with H. E. Hartig), Journal-Lancet 56:393-96 (July) 1936.

24. How to Safeguard our Hearing, in Fisher, I., and Emerson, H.: How To Live, 20th Edition, New York, Funk and Wagnalls Company, 1938, Appendix 20, p. 317.

25. Hearing Problems in Education, J. A. M. A. 109:839-41 (Sept. 11) 1937.

26. The Early Detection and Treatment of Defective Hearing in Children, J. A. M. A. 109:1620-23 (Nov. 13) 1937.

27. Hearing Deficiencies in Relation to Speech Defects, Laryngoscope 48:129-36 (Feb.) 1938.

28. Deafness Prevention and Amelioration, Bull. of Amer. Acad. Ophth. and Otolaryng. 7:10-11 (Aug.) 1938.

29. Hearing Deficiencies in Relation to Speech Defects, J. Speech Disorders 3: 247-52 (Dec.) 1938.

30. A New Pure Tone Audiometer for School Use, Arch. Otolaryng. 28:777-79 (Nov.) 1938.

31. An Efficient and Practical Booth for Testing Hearing (with H. E. Hartig), Arch. Otolaryng. 28:1000-1002 (Dec.) 1938.

32. Hearing Aids (with H. E. Hartig), Arch. Otolaryng. 29:614-20 (April) 1939.

33. Audiometers, in Piersol, G. M.: The Encyclopedia of Medicine, Philadelphia, F. A. Davis Company, 1939, pp. 364-70.

34. Discussion of Dr. Gordon Berry's paper on "The Use and Effectiveness of Hearing Aids," Laryngoscope 49:940-42 (Oct.) 1939.

35. Unusual Bacterial Findings in a Fatal Case of Chronic Otitis Media with Complications, Laryngoscope 49:1024-30 (Oct.) 1939.

36. Report of the American Otological Society Representatives on the Committee on Audiometers and Hearing Aids of the Council on Physical Therapy of the American Medical Association, Laryngoscope 49:1032-33 (Oct.) 1939.

37. Discussion of Dr. Max A. Goldstein's paper on "Defective Speech in Relation to Defective Hearing," Tr. Amer. Laryng. Assn. 61:45-46, 1939.

38. Recent Progress in Otology, Minnesota Med. 23:165-69 (March) 1940.

39. Lectures on Otology for Undergraduates, University of Minnesota Mimeograph Department, 1940, 43 pages.

40. Prevention and Amelioration of Hearing Deficiencies. Continuation Course in Otolaryngology at University of Minnesota Center for Continuation Study, February, 1940, 8 mimeographed pages.

41. Hearing Impairment in College Students, Journal-Lancet 61:92 (March) 1941.

42. Progress in the Conservation of Hearing, ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY 50:129 (March) 1941.

43. Observations on the Conservation of Hearing, Laryngoscope 50:847-55, 1940.

44. Report on the Committee on the Conservation of Hearing, Tr. Amer. Acad. Ophth. and Otolaryng. July-August, 1941, pp. 25-28.

45. Possibilities of Attainment in the Conservation of Hearing, Proc. Inter-State Postgraduate Medical Assembly of North America, October 13-17, 1941.

46. Discussion of Dr. William E. Grove's paper on "The Hard of Hearing in Industry," Tr. Sec. on Laryng., Otol. and Rhin., Amer. Med. Assn. 92:101-103 (June 2-6) 1941.

47. The Medical Follow-up of Hearing Impairments, J. School Health 12:291, 1942.

48. Presentation of a Simple Device for Excluding Interfering Noises from One Ear While Testing Hearing Acuity of the Other Ear, Laryngoscope 52:983, 1942.

49. The Administration of an Organized Program. Symposium on the Detection and Treatment of Impaired Hearing in School Children, Tr. Amer. Acad. Ophth. and Otolaryng., March-April, 1943, pp. 319-21.

50. Syllabus of Audiometric Procedures in the Administration of a Program for the Conservation of Hearing of School Children (Edited with Scott N. Reger, for the Committee on Conservation of Hearing), Tr. Amer. Acad. Ophth. and Otolaryng., April, 1945.

ROBERT LEVY, M.D.

1864-1945

Dr. Robert Levy died July 1, 1945, in Denver, Colorado, at the age of 81 years. He is survived by two daughters, Mrs. Leona L. Eichberg and Mrs. Samuel Rose, of Denver. His wife, the former Rebecca Goldsmith, died in 1940.

Dr. Levy was born in Hamilton, Ontario, May 30, 1864. After attending the University of Denver, he received his M.D. degree from Bellevue Hospital Medical College, New York, in 1884, and later did postgraduate work in Berlin, Vienna and Freiberg.

He began the practice of medicine in Denver in 1884 with his uncle, Dr. John Elsner. After five years of general practice, he took up otolaryngology as a specialty and continued in this until his death.

Always active in his specialty Dr. Levy held many distinguished positions pertaining to it. From 1887 to 1895 he was Professor of Laryngology, Rhinology and Physiology at Gross Medical College, Denver, becoming Professor of Otolaryngology at the Denver and Gross College of Medicine when these two schools consolidated in 1895. In 1911 the Denver and Gross College merged with the University of Colorado School of Medicine and Dr. Levy was Professor of Otolaryngology at that institution until 1936 when he was made Professor Emeritus. He also served as Secretary of the Gross Medical College and from 1902-1909 of the Denver and Gross College; in 1896 he was elected president of the Colorado Medical School. He was otolaryngologist to the Colorado General, St. Joseph's, Denver General, St. Luke's, Children's and the National Jewish hospitals, at which latter institution he served as Chairman of the Medical Advisory Board for the past 35 years.

Among the societies of which Dr. Levy was a member are: the American Laryngological Association; the American Medical Association, serving as Chairman of the Section on Otolaryngology in 1916; the American Academy of Ophthalmology and Otolaryngology; the American Laryngological, Rhinological and Otological Society, serving as President in 1915; the American College of Surgeons; the Colorado State and other local medical societies.

During the first World War he served in the United States Army Medical Corps and was discharged with the rank of major in 1919.

Dr. Levy was the author of numerous articles on otolaryngological subjects, especially on laryngeal and oral tuberculosis, and contributed chapters on laryngeal surgery to Loeb's "Operative Surgery of the Nose, Throat and Ear."

Among the many honors bestowed upon him, in 1932 he was elected president for the third time of the Denver Clinical & Pathological Society and made President Emeritus. On April 4, 1934, the Denver Medical Society commemorated Dr. Levy's 50th anniversary in the practice of medicine, and a portrait of him by Waldo Love was presented to that association.

In addition to his activities in medical circles, Dr. Levy was concerned with all philanthropic and community activities. He participated in the organization of the local Community Chest and several years ago a medal was presented to him for this outstanding service.

He was a Trustee of Temple Emanuel for forty years, later serving as President, and being elected Honorary President for life. In his youth he was organist in a Methodist Church.

In 1923 Dr. Levy toured Japan where he delivered a series of lectures, making the principal address at the dedication ceremonies of the Hospital and Medical School in Tokyo.

He was an extensive traveller and delivered many illustrated talks on foreign lands and people. He steadfastly refused to retire, contending that a man was not old as long as he retained his sense of humor. He was able to perform operations in his later years with the same skill and steadiness of hand that he displayed in his younger days. He was Dean of otolaryngologists of the West and a national figure for many years.

THOMAS E. CARMODY.

PUBLICATIONS OF DR. ROBERT LEVY

1. Chronic Laryngitis—1886.
2. Abscess of the Brain with Report of a Case and Autopsy—1887
3. Epistaxis—1891.
4. Diagnosis of Empyema of the Antrum of Highmore—1892.
5. Free Medical Education—1894.
6. Laryngeal Papillomata in Children—1894.
7. Inoperable Sarcoma of the Nose—1894.

8. Treatment of Empyema of the Antrum of Highmore—1894.

9. Dainage and Irrigation of the Maxillary Antrum—1894.

10. Treatment of Laryngeal Tuberculosis—1895.

11. Pharyngeal Tuberculosis—1896.

12. Direct Autoscopy; Kirstein with Demonstration—1896.

13. Fatal Hemorrhage from the Nose and Pharynx from Unusual Cause; with Exhibition of Specimen—1896.

14. Exaggerated Arytenoid Movement—Anchylosis of the Crico-Arytenoid Articulation—1896.

15. Medical Education—1897.

16. Sinus Thrombosis—Cure without Opening the Sinus—1899.

17. Prognosis of Laryngeal Tuberculosis—1899.

18. Syphilis of the Nose—1900.

19. The Lingual Tonsil—1900.

20. The Tonsils—1901.

21. Essentials in the Treatment of Laryngeal Tuberculosis—1902.

22. The Effect of Climate on Laryngeal Tuberculosis with Special Reference to High Altitudes—1902.

23. The Treatment of Acute Otitis Media Purulenta—1903.

24. The Prognosis of Laryngeal Tuberculosis—1904.

25. The Relations of Diseases of the Stomach to Afflictions of the Mouth, Nose and Throat—1904.

26. Treatment of Asthma—1905.

27. The Dunbar Treatment of Hay Fever—1905.

28. Indications for the Submucous Resection of the Nasal Septum—1906.

29. Surgical Treatment of Tuberculosis of the Upper Air Passages and the Ear—1906.

30. Sore Throat in Pulmonary Tuberculosis—1906.

31. The Teaching of Laryngology and Rhinology in the Denver & Gross College of Medicine—1906.

32. Sarcoma of the Nose with a Consideration of the Spontaneous Disappearance of Malignant Growths—1906.

33. Chronic Suppurative Maxillary Sinusitis—1906.

34. Aneurism of the Aorta—1907.

35. Tuberculosis of the Mouth—1907.

36. Vaccine Therapy in Otology and Rhino-Laryngology—1909.

37. Laryngeal Tuberculosis—1909.

38. The Tuberculous Tonsil—1910.

39. Tumors of the Larynx—1912.

40. Diagnosis and Indications for Treatment of Suppurative Diseases of the Nasal Accessory Sinuses—1913.

41. Byren's Physiology of the Semicircular Canals and their Relation to Seasickness—1913.

42. The Dignity of Otolaryngology—1913.

43. Nasopharyngeal Polypus—1914.

44. Address in Laryngology—1914.

45. Suspension Laryngoscopy in Children—1914.

46. Esophagotracheal Fistula—1916.

47. Nasal Accessory Sinus Disease; Diagnosis—1920.

48. Otolaryngology at Camp Lewis—1920.

49. Some Problems Connected with Tonsillectomy in the Tuberculous—1920.

50. Colorado's Climate upon the Upper Air Passages—1921.

51. Manifestations of Paranasal Sinusitis—1926.

52. The Anesthetic Problem in Otolaryngology—1930.

53. Sigmoid Sinus Thrombosis—1931.

54. Chloromo (Its Relation to Otolaryngology)—1931.

55. Progress in Otolaryngology—1932.

Abstracts of Current Articles

EAR

Penicillin and Primary Suture in Treatment of Acute Surgical Mastoiditis.

Johnson, Leighton F., Weinstein, Louis, and Spence, Philip S.: Arch. Otolaryng. 41:408-412 (June) 1945.

The authors used penicillin locally after mastoidectomy on 23 patients with suppurative mastoiditis following scarlet fever and measles. The wounds were tightly closed in two layers at the time of operation leaving a ureteral catheter extending through the line of incision to the antrum—10,000 units of penicillin in 2 cc. was injected through the catheter every eight hours for four days (a total of 120,000 units). Seventeen patients showed complete cure after one course of treatment. Six developed suppuration again and had to be given a second course.

HILDING.

Causal Relationship of Lymphoid Tissue About Eustachian Tubes and Ear Pathology: Case Reports.

Baker, Earl E.: Laryngoscope 55:174-178 (April) 1945.

In recent years the relation of impaired hearing to the presence of lymphoid tissue about the eustachian tube has caused considerable discussion in otolaryngologic circles.

Baker feels that in many instances this condition would not occur if, during adenoidectomy, the surgeon paid more attention to the tubal area. Following the removal of the adenoids he exerts moderate pressure with the forefinger against the tube and adjacent structures, thereby breaking away any lymphoid tissue and bands about the tube.

Baker also refers to radiation as an effective method of removing lymphoid tissue from this area.

VAN ALYEA.

Mastoiditis Masked by Chemotherapy.

Noriega, Carlos: *Rev. de Otorrlaring.* 4:124 (Sept.) 1944.

Along with the discovery of the sulfonamides it was hoped there would be a greatly reduced incidence of mastoiditis and its complications resulting from acute otitis media. During a period of observation covering three years, the author's experience warrants a new evaluation of the efficacy of sulfonamide drugs.

Of late he has been restricting the use of these drugs and states that many clinicians in other countries are also curtailing their application and that some do not even use them at all.

When sulfonamide therapy is used, the form of the preparation should be selected according to the bacteriological examination of the discharge. It should be used early and in sufficient dosage to achieve a blood concentration of ten to fifteen mg. per 100 cc. Patients receiving these drugs are always confined to the hospital for careful study during this treatment.

Thirteen clinical observations are recorded. In this series there were two deaths, one from brain abscess and one from meningitis. In both cases it is assumed that the sulfonamide masked the signs of these complications.

HIGBEE.

Lempert Fenestra Nov-Ovalis with Mobile Stopple.

Lempert, Julius: *Arch. Otolaryng.* 41:1-41 (Jan.) 1945.

In this article, the author gives his conclusions as to the results in 1000 cases of clinical otosclerosis operated by the fenestration operation. The article is clear and very well illustrated. In the first 300 cases the fenestrum was made in the external semicircular canal, whereas in the remaining 700 it was made further anterior in what the author terms the surgical dome of the vestibule. The fenestrum closed again after operation in 140 cases. Eighty-eight of these closures occurred in the first 300 cases and only 52 in the later 700.

The author divides the 1000 cases into two groups: 815 with good hearing for bone conducted sound and 185 with poor hearing for bone conducted sound. The results were better in the former group. Complete rehabilitation for social and economic contacts was accomplished in 571 cases (70%). Partial rehabilitation was accomplished in 92 (11.3%). One hundred eighteen (14.5%) remained unimproved and 34 (4.1%) suffered further hearing impairment.

The two main cases of failure are closure of the fenestrum by new bone formation and serous labyrinthitis. The author believes that he has overcome both difficulties by means of a cartilaginous stopple with which he closes the fenestrum as soon as it is made. His results from this new procedure are not given, excepting some sample audiograms.

HILDING.

The Use of Otosmosan in Otology: A Clinical Report.

Kopetzky, Samuel J.: Laryngoscope, 55:216-225 (May) 1945.

Kopetzky applied a solution composed of urea, 10.82% and sulfathiazole 9.68% in glycerine (Otosmosan) in the treatment of suppurative conditions of the ears. He used the treatment in cases of long-standing purulent ear discharge, in cases in which a simple mastoidectomy had been performed many years previously, in acute suppurative otitis media, and in cases following radical mastoidectomy which presented cavities secondarily infected with discharging ears. In all types of cases the majority obtained considerable relief.

He felt that the solution had no effect in cases of bone necrosis or those showing exuberant granulations or polyps. He did feel, however, that it was beneficial as a cleansing agent and deoderant and found that many of the old suppurative, chronic ears, which had failed to respond to other forms of medication, showed a lessening or a complete absence of discharge following daily application of the urea-sulfathiazole combination over a period of a few weeks.

VAN ALYEA.

On Closing Tympanic Membrane Perforations.

Fox, Samuel L.: South. M. J. 38:492 (July) 1945.

The Selective Service medical induction examinations of the past four years have revealed a greater incidence of tympanic membrane perforations than otologists would have guessed could exist among the youth of America. The condition has accordingly taken on an added importance to otologists and their patients, and to the armed services.

Experience has developed certain criteria for the selection of cases suitable for closure. The middle ear must have been dry for at least several months and preferably for a year or more, as otherwise closure of the perforation may be followed by an acute suppurative otitis

media necessitating myringotomy. Marginal perforations are unsuitable for closure since there is usually an overgrowth of the stratified squamous epithelium of the canal over the annulus into the middle ear, so that excretory and secretory products are constantly being formed in the middle ear. To close such a perforation would lead only to suppurative otitis media.

Having determined that the middle ear is dry and having cleansed the canal with 70 per cent alcohol, the edges of the perforation are carefully touched with a fine-wire cotton applicator saturated with trichloracetic acid to denude the epithelium from the free margins of the perforation. It is important that no excess acid be allowed to spill into the middle ear. This is accomplished by dipping the applicator in the acid and thoroughly drying it with a cotton pledget. A dry cotton pledget is placed in the ear canal, and the patient is instructed to return the next day. If the cauterization has not produced a discharge from the middle ear, a piece of Cargile's membrane 1.5 times the diameter of the perforation is placed against the drum so as to cover the perforation. This is accomplished by wetting a cotton applicator with normal saline or distilled water; the Cargile membrane will adhere to the end of the cotton applicator by capillary attraction. When the applicator is placed against the drum, the membrane detaches itself from the applicator and adheres to the drum. Careful manipulation will place the membrane completely over the perforation, where it will serve as a "bridge" under which the tympanic membrane will grow. Cargile's membrane being practically transparent, the progress of the epithelization can be watched and the formation of any fluid in the middle ear can be observed. If the middle ear remains dry, the Cargile membrane is left in place until the perforation is healed, a process usually requiring from one to four weeks, when the membrane will separate itself from the drum.

The author has successfully closed several dozen tympanic membrane perforations by this method. In the small perforations (2 mm. or less), the scar is practically imperceptible and the hearing almost always improved 15 to 20 db. or more for the lower tones.

The author feels that closure of central tympanic membrane perforations is feasible in cases where the middle ear is dry and where the perforation is not larger than 4 or 5 mm. Several patients in whom such perforations were closed have since entered the armed services, and two have been accepted in the Air Corps.

TAYLOR.

NOSE

Chemotherapy of Nasal Sinus Disease.

Whalen, Edward J.: Connecticut State M. J., Vol. 9, No. 6, June 1945.

The author states that it is illogical to use sulfonamide medication for local application to the unbroken mucous membrane of the nose with the expectation that organisms in the soft tissues will be affected. He feels that in sinus disease with congested membranes blocking the ostia little reliance can be placed upon the displacement method as a means of introducing medication into the sinuses. Experiments with wetting solutions to increase the permeability to medication have likewise been unsatisfactory. The present wave of conservatism in the treatment of sinus disease has led to abuses of treatment by drops and sprays.

While in acute cases he limits surgical procedures to fracture of the middle turbinates, in chronic cases drainage and the removal of the products of infection are essential. He advocates the use of sulfonamides in adequate dosage by oral or intravenous administration to supplement logical surgical treatment. Following surgery the exposed sinus areas may be treated locally with soluble sulfanilamide crystals.

HILL.

Etiology and Pathology of Deformities of the Nasal Pyramid.

Alcaino, Alfredo: Rev. de Otorrlaring. 3:184 (Dec.) 1943.

This author divides the nasal pyramid into the superior or osseous and the inferior or cartilaginous portions. Similarly he considers the septum as divided into a posterior or osseous portion and an anterior or cartilaginous portion. The anatomical structure of the whole nose is composed of a bony nonmovable part posteriorly and an anterior cartilaginous part which is freely movable.

He states that developmental abnormalities in the maxilla and the formation of palatine arches are responsible for nontraumatic deformities which result in a high palatal arch and consequent shortening of the vertical diameter of the septum. Thus septal deviations are created in the developmental stage.

The author classifies deformities as follows:

1. External deformities, which include hump nose, deviation to one side, and hypertrophy of the tip.

2. Internal deformities, which include septal deviations and the congenitally narrow nose.

3. Deformities of the columnella of congenital or traumatic origin and abnormally short upper lip.

Dr. Alcaino believes that reconstructive surgery should be done by rhinologists who, by reason of their training and greater familiarity with the region, are best suited for this work.

HIGBEE.

PHARYNX

Penicillin Therapy in Hemolytic Streptococcic Pharyngitis and Tonsillitis.

Plummer, Norman, Duerschner, D. R., Warren, H. D., Rogliano, F. T., and Sloan, R. A.: *J. A. M. A.* 127:369-374 (Feb. 17) 1945.

The use of chemotherapy in the treatment of throat infections is very thoroughly covered with seven charts.

The method of culture from the nasopharynx is to be commended and the authors believe it is much to be preferred to cultures from other parts of the nose or throat. It has given positive cultures when smears from other regions have been negative. It is interesting to note that the results of treatment are largely due to the length of time treatment is carried out. However, as the authors all have noted, the result may be partially due to the virulence of the organism producing the pathology present.

This study, like many other scientific investigations, answers a few questions but poses many more. The results show evidence that penicillin, if given over a sufficient period of time, will shorten and alleviate the acute symptoms of hemolytic streptococcic pharyngitis-tonsillitis. There is some indication that complications of this disease can be prevented and effectively treated. The authors' most striking observation is the effect of penicillin on the hemolytic streptococcus in the nasopharynx.

Relapse, as the authors suggest, may be due to insufficient treatment but it might also be due to reinfection. The authors' summary is of extreme interest.

1. Fifty-four patients with severe acute pharyngitis-tonsillitis were studied clinically and bacteriologically. Forty-five of these had cultures positive for Group A (Lancefield) hemolytic streptococci

and were suitable for making a comparison of different therapeutic measures.

2. In 28 of the 45 positive cases, penicillin was given intramuscularly in a dosage of 15,000 units every four hours over periods varying from 24 hours to six days; sulfadiazine was given in 11 cases and no specific therapy in 6.

3. Penicillin was found to exert a pronounced effect on the number of hemolytic streptococci in the nasopharynx. The culture made 24 hours after the start of penicillin was almost always negative, and the serial cultures during the course of therapy remained negative. When penicillin was discontinued, hemolytic streptococci tended to return gradually to the nasopharynx. The frequency of their reappearance in our cases was inversely proportional to the length of time the drug was administered.

4. In 19 patients treated with penicillin for 64 hours or more symptomatic relief commenced in eight to twelve hours after the beginning of therapy and was complete in 24 to 36 hours. However, clinical relapse of the pharyngitis-tonsillitis occurred in 4 of the 9 patients treated for less than four days but in none of the 10 treated for six days. One patient treated with penicillin for six days subsequently developed acute hemolytic streptococcic sinusitis and pneumonia. Throughout the study relapses and complications always were associated with the presence of reappearance of hemolytic streptococci in the nasopharynx.

5. This study reveals further evidence of the high antihemolytic streptococci action of penicillin and emphasizes its value in dangerous hemolytic streptococcic infections. Penicillin in minor hemolytic streptococci infections may be beneficial, but further investigation will be required to ascertain its exact indications and contraindications in these conditions.

This experiment emphasizes the value of careful observation of each case.

CARMODY.

ESOPHAGUS

Surgical Management of Carcinoma of the Midthoracic Esophagus.

Sweet, Richard H.: New England J. Med., Vol. 233, No. 1, July, 1945.

Experience with the Torek operation has been unsatisfactory, particularly because it disregards the subdiaphragmatic periesopha-

geal nodes. Out of a series of 14 patients operated on, only two were alive and well four and two years after operation. Resection with high esophagogastric anastomosis has given very satisfactory results. Twenty such operations have been done with six deaths, a mortality rate of 30%.

The author describes the technique of the operation which is aimed at freeing the stomach sufficiently to bring the fundus to the level of the aortic arch or, when necessary, above it, in which case the upper end of the esophagus is mobolized and pulled up in front of the arch.

HILL.

MISCELLANEOUS

An Analysis of Colds in Industry.

Kler, Joseph H.: Arch. Otolaryng. 41:395-407 (June) 1945.

This is a statistical study in which the author seeks to gather basic and detailed facts concerning the occurrence of colds in industry. The study is made in the Johnson & Johnson plants of Chicago and New Jersey. He finds that more than one third of all time lost in industry is due to colds. The greatest incidence is in December and October. Sudden drops in temperature are followed by increase in incidence. There is a much greater incidence on Monday than on other days. Among women, there is a much greater incidence on the first day of menstruation than during any other day during the cycle. The incidence and severity of colds are much greater among office workers than factory workers and tends to be greater in drafty places. Women have more colds than men (probably due to factor of menses). Youth has more than age, but the severity increases with age. In a table the employees are divided into four groups on a basis of activity. The greatest percentage of all colds is found to be among those who sit at their work and the lowest among those who walk about. These percentages would indicate relative incidence only if the four groups are of the same size, something which the author fails to state. The author has very obviously put forth a great deal of effort in making this study.

HILDING.

The Use and Abuse of Nasal Vasoconstrictor Medications.

Kully, Barney M.: *J. A. M. A.* 127:307-310 (Feb. 10) 1945.

The author's opening statement that, "No class of drugs is more widely distributed and used than are nasal vasoconstrictors," is not to be questioned. He further states that there are at least 248 nationally distributed preparations advertised for this purpose.

That some of these preparations are of value when used as adjuncts to examination and surgical procedures, the author is in accord. However, when they are used in acute and chronic states their reaction is often found by the patient to be much less desirable than the original pathological state.

Furthermore, it is difficult to get patients to discontinue their use. While the manufacturer may be partially at fault for this, physicians must take a fair share of the blame.

The addition of antiseptics, and especially of sulfathiazole, has tended to increase irritation of the mucous membranes. In his summary we may well call attention to two points: judicious use of vasoconstrictive medications is indicated in surgical, manipulative and displacement procedures and in some acute nasal infections, notably acute sinusitis; the indiscriminate use of this medication in acute rhinitis lengthens the course of infection and increases the incidence of sinus and otitic complications.

CARMODY.

The Importance of Erythrosedimentation in the Treatment of Septic Foci.

Elishet, Felipe Cora, and Montero, Juan: *La Revis. de Med. y Cien. Afines.* 6:1037 (Dec.) 1944.

This article relates the experience of the authors with the sedimentation test. These conclusions indicate that they attach considerable importance to it. They give the following interpretations:

1. Abnormally rapid sedimentation indicates an active septic focus.

2. The test should be performed before any operation designed to remove such a focus.

3. When the rate of sedimentation is very high, operation should be postponed if possible and an effort made to raise the resistance of the patient.

4. Surgery is performed with the most favorable outlook as regards complications and convalescence if performed when the sedimentation time is within normal limits.

HIGBEE.

The Use of Penicillin in Vincent's Angina.

Shallenberger, P. L., Denny, E. R., and Pyle, H. D.: J. A. M. A. 128:706-710 (July 7) 1945.

The authors give a short history of experimental work on the effect of penicillin on spirochetal infections and give cuts of a number of slides showing organisms before treatment, three hours later, and seven hours after institutional treatment.

Other treatment was given to four groups before penicillin was used.

Group 1 consisted of 13 patients admitted during November and December, 1943, who were treated variously with hydrogen peroxide, sodium perborate, chromic acid, silver nitrate and oxophenarsine hydrochloride (mapharsen). Most of this group were treated by swabbing the involved areas three times daily with a mixture of 3 per cent chromic acid and 10 per cent silver nitrate, preceded by gargling a mixture of equal parts of 50 per cent sodium perborate and 50 per cent hydrogen peroxide. A few of the patients received, in addition to this treatment, and others alone, 0.03 gm. of oxophenarsine hydrochloride intravenously every second or third day.

Group 2 consisted of 11 patients admitted during January and February, 1944, who were treated with 1 gm. doses of sulfadiazine, used as lozenges, every four hours.

Group 3 consisted of 9 patients admitted subsequent to February, 1944, and treated with penicillin by local application. The following method was used:

1. The involved tissues were swabbed with penicillin in a concentration of from 250 to 500 units per cc. four times daily.

2. Daily smears were made.

3. Treatment was continued until the smears were negative for Vincent's organisms.

No other supportive treatment was administered, although acetylsalicylic acid, 5 grains (0.32 gm.), was given as indicated for the relief of pain.

As the investigation progressed, concentrations of the penicillin solution used were maintained at 500 units per cc.

Group 4 consisted of 2 patients treated with penicillin administered intramuscularly alone. One of those was treated with penicillin intramuscularly because his symptoms were unusually severe. In order to determine the clinical and bacteriologic effectiveness of penicillin following intramuscular administration, the second patient of this group was subjected to detailed study. The procedure in investigating this patient was as follows: (1) Culture and (2) warm carbolized crystal violet-stained smears of the lesions were made on admission; (3) 15,000 units of penicillin in a concentration of 10,000 units per cc. was administered intramuscularly every three hours for eight doses; (4) following the institution of penicillin treatment estimates of the number of Vincent's organisms on stained smears were made hourly for twelve hours and subsequently at less frequent intervals; (5) the changes in objective and subjective symptoms were observed at the time specimens were obtained for bacteriologic examinations.

The treatment with penicillin was both local and by intramuscular injections. Local applications consisted of 500 units to 1 cc. salt solution, while the intramuscular injections consisted of 15,000 units every three hours.

The authors believe that the efficiency of penicillin is due to the fact that Vincent's organisms are especially sensitive to the penicillin in sufficient concentration.

In a footnote they recommend 25,000 units every three hours for four doses.

It is well known that the larger doses repeated every three or four hours keep the concentration in the blood much better than small doses and, we believe, there is more even absorption than when penicillin is given intravenously.

We feel that this is a distinct contribution to the treatment of spirochetal infections, especially of the oropharynx.

CARMODY.

Effectiveness of Penicillin in the Treatment of Vincent's Angina.

Schwarz, Bernard M.: J. A. M. A. 128:704-706 (July 7) 1945.

Report of 14 cases. Most of the cases tabulated seem to be limited to infection of the tonsils, with report of positive smears. Most of the patients had been previously treated with hydrogen peroxide or perborate of soda.

The organisms disappeared from smears in from one to ten days, as did exudation, following intramuscular injections of from 25,000 to 200,000 units, 20,000 units every three hours.

The brilliant results of this treatment are well shown but it might be compared with other treatments which have given good results.

CARMODY.

Fibrous Dysplasia of the Skull: A Probable Explanation for Leontiasis Ossea.

Pugh, David G.: Radiology 44:548 (June) 1945.

Fourteen radiographs of the skull and three of the long bones demonstrate fibrous dysplasia and reasons for the authors conclusions that (1) lesions of the skull associated with polyostotic fibrous dysplasia have a characteristic roentgenologic appearance, (2) fibrous dysplasia of the bones of the skull occurs at times without obvious involvement of the remainder of the skeleton, (3) if fibrous displasia of the bones of the skull is found, roentgenologic examination of the entire skeleton should be carried out, (4) in most cases it seems probable that leontiasis ossea is a manifestation of fibrous dysplasia of the bones of the skull.

JORSTAD.

Tomography of the Skull.

Halvey, E. H., Rosenthal, L. M., and Anson, B. J.: Radiology 44:425 (May) 1945.

In a series of 38 figures the authors illustrate in detail the normal anatomic structures of the adult skull by tomographic roentgenograms gross section photographs. Comparison is made between these serial films and sections of the cadaver head at corresponding levels.

Tomograms were taken at 0.5 cm. levels with the head in anteroposterior position for one series. Another head was used for right lateral and left lateral tomograms at 0.5 cm. levels. These heads were

then sectioned to duplicate the corresponding levels in each series of positions. The tomographic technique and anatomical features are discussed in detail.

JORSTAD.

The Relationship of Allergy to Medicine.

Barr, David P.: Journal of Allergy, March, 1945.

Dr. Barr has briefly but accurately described the development of allergy as a specialty. He tells us that medicine was studied and practiced until 1900 without any knowledge of allergy, of hypersensitiveness, or of anaphylaxis, and that one of the most significant contributions to the subject that later became known as allergy was made by Sir William Osler.

It became a well-known fact that the offending substances or antigens introduced into the sensitive individual brought about an anaphylactic response and that these antigens were proteins or some compounds of proteins. The reactions varied markedly in different species and in different individuals, and the outstanding feature of the anaphylactic reaction was a spasm of smooth muscle associated with an increased capillary permeability. It was later demonstrated that reinjections of sublethal amounts of the antigen might result in temporary, more or less complete, desensitization or immunity. Later, the term allergy was broadened to include bacterial hypersensitiveness in man and in animals as well as all forms of nonbacterial hypersensitiveness. The degree of reaction depends on the amount of toxic material or antigen and also upon the quantitative relationships between antigen and antibody, in the patient's blood serum.

Dr. Barr gives many excellent reasons justifying the specialty of allergy which is still a comparatively young specialty and in which the following undesirable situations have sometimes arisen:

1. Some allergic practice has tended to stray away from the fundamental principles of general medicine.

2. The field itself has become, in actual practice, too restricted.

3. There have been among some allergists in certain quarters a too uncritical appraisal of the methods of diagnosis and treatment.

4. The development of the specialty has tended to deprive other practitioners of active participation.

The author emphasizes the fact that the concept of altered reaction to bacterial and nonbacterial substances is one of the most important ideas of medicine today, and that it ranks with psychosomatic medicine, with the study of the circulatory apparatus, with bacteriology, with metabolism, and with clinical chemistry. On the other hand, he emphasizes the fact that the allergist must be thoroughly trained in internal medicine and also an excellent diagnostician. In dealing with hay fever, the allergist must be well acquainted with the problems of nasal infection, of sinusitis, and other diseases of the upper respiratory tract, and that the allergist should have a thorough acquaintance with nasal pathology and its relation to the allergic nose.

McLAURIN.

Treatment of Ragweed Pollinosis With Antigen-Antibody Mixtures.

Cohen, Milton B., and Friedman, Harold J.: Journal of Allergy, May, 1945.

Drs. Cohen and Friedman report a new plan of desensitizing ragweed-sensitive individuals by the use of antigen-antibody mixtures and their observations would indicate that they have obtained far better results in the few cases that have been so treated than they could have expected by desensitization with the antigen alone. They summarized their findings as follows:

1. Mixtures of thermostabile antibody and pollen extract which were approximately neutral or contained not more than 100 units of free antigen per milliliter were prepared.

2. These mixtures stimulated the production of thermostabile antibody in both normal and pollen-sensitive individuals.

3. The mixtures were administered to sensitive patients in individual doses containing as much as 12,000 PTA units of "neutraized" antigen without systemic reactions.

4. Three pollen-sensitive persons treated with these mixtures obtained good clinical results with only three to four injections of the material.

McLAURIN.

Vitamin C in Hay Fever: Therapy and Blood Levels.

Sidney, Friedlaender, and Feinberg, Samuel M.: Journal of Allergy, May, 1945.

These two authors have presented a very excellent study as to the role that vitamin C plays in the control of hay fever. They have set

out to determine the real facts in this matter as far as they are able to do so. They state, however, that it is difficult to always evaluate the results in any hay fever therapy because of various factors, such as concentrations of pollen in the air, the difference in individual response, the factors of cold and rain on the aggravation of symptoms, and always the psychic suggestions that are some times responsible for a fair percentage of claimed improvement.

Their report is based on observations made on 43 hay fever patients during the 1944 ragweed season. Their final conclusion in these cases is as follows:

1. Hay fever patients have a normal blood level of vitamin C.

2. Large doses (500 mg. daily) of vitamin C produce the usual saturation blood levels, but do not change the course of the hay fever or asthma.

McLAURIN.

Penicillin and Sulfonamides in the Therapy of Actinomycosis—Report of Sixteen Additional Cases and In Vitro Tests of Susceptibility of Actinomyces to Penicillin and Sulfadiazine.

Dobson, Leonard, and Cutting, Windsor C.: J. A. M. A. 128:856-7 (July 21) 1945.

The results in 16 cases seem to show the value of treatment of this condition with mixed sulfadiazine and penicillin but we must also call attention to the fact that a number of their patients were also treated with iodine and x-rays so that all the credit should not be given to the sulfonamides and penicillin.

Relapses have occurred which was true of the older methods of treatment. Therefore, we should use any method of treatment which will give satisfactory results. Surgery is found necessary in many cases and should be resorted to when drainage is necessary.

CARMODY.

Anesthesia for Tonsillectomy, Induced by Intravenous Administration of Pentothal Sodium.

Fox, S. L., and Rochberg, Samuel: Arch. Otolaryng. 41:439-440 (June) 1945.

The authors have used pentothal sodium intravenously to induce general anesthesia for tonsillectomy in 300 cases. Several advantages are claimed for it, among which are shorter induction time, absence

of retching and vomiting. It is stated that it may be used in the presence of infection of the respiratory tract and that fluids may be taken after operation.

HILDING.

"Sulfa" In Wounds Discontinued.

Release from the office of the Surgeon General of the Army.

The Army's accumulated experience in wound management does not justify the local use of any chemical agent in a wound as an antibacterial agent, according to the Office of The Surgeon General. The local use of crystalline sulfonamides (sulfa powder) has therefore been discontinued except in the case of serous cavities where its use, while permissible under the direction of the surgeon, is not recommended. This subject is covered by War Department Circular No. 160 as amended by W. D. Circular No. 176, 1945.

HANAU W. LOEB MEMORIAL

[The following addresses were delivered on the occasion of the establishment of a Lectureship at St. Louis University School of Medicine in memory of Hanau W. Loeb, former Editor of the Annals, by Phi Delta Epsilon on April 9, 1945.]

PRESENTATION OF THE HANAU W. LOEB LECTURESHIP ON BEHALF OF PHI DELTA EPSILON

ARTHUR E. STRAUSS, M.D.

PAST GRAND CONSUL

Mr. Chairman, honored guests, ladies and gentlemen:—

It is indeed a great privilege to be called upon tonight to speak on such an auspicious occasion and in the presence of this assembly. You all know the purpose of this meeting so I do not think it would be amiss for me to review briefly the history of Phi Delta Epsilon.

Phi Delti Epsilon was founded at Cornell University Medical School in 1904 by the late Dr. Aaron Brown. From the small group of students who associated themselves with him some 40 years ago the fraternity has grown and expanded until it now has 47 active undergraduate chapters in the Class A medical schools of the United States and Canada and 17 graduate clubs. We are proud of this development because it exemplifies the need and value of such an organization.

The preamble to our constitution reads as follows: "Phi Delta Epsilon Fraternity has been established to promote the highest scientific, literary and educational standards among its members as well as the medical profession at large; to promote good fellowship, equality and unity among its members; and to uphold and maintain the highest standards of ethics in the practice of medicine."

While attempting to fulfill the ideals as just expressed, we are not unmindful of the privilege which has been ours to study, to teach, and to practice medicine.

We are proud of the accomplishments of our undergraduates as evidenced by their scholastic records and of our graduates, so many of whom are actively engaged in teaching as well as in the practice of medicine. We are proud of the more than 2500 of our members who are serving with the armed forces.

Alpha Pi Chapter of the St. Louis University School of Medicine has sought, in accordance with the policy of Phi Delta Epsilon, to express its appreciation of the happy relationship between its members and the school by the establishment of an annual lectureship. As

soon as the decision to provide such a lectureship was made, we had no difficulty in choosing the one we wished to honor by giving the lectureship his name. As Phi Delta Epsilon grew and developed through the interest, enthusiasm and judgement of its founder, Aaron Brown, so too did St. Louis University School of Medicine grow and mature under the guiding hand of Hanau W. Loeb. Always interested in medical education, "H. W.", as we fondly knew him, served as Dean of the Medical School from 1913 until his death in 1927, and his enthusiasm, his energy, his sincerity and judgment served to place St. Louis University School of Medicine on the high plane which it has since maintained and further developed under the guidance of Father Schwitalla.

Dr. Loeb, while showing a singleness of purpose in accomplishing any task he set himself to do, was not limited in his activities, for his interests in the community were broad and in his chosen field of otolaryngology he received high national honors.

Alpha Pi Chapter and Phi Delta Epsilon feel that they are being honored by the privilege of naming this lectureship, the Hanau W. Loeb Lectureship.

I cannot close these remarks without publicly acknowledging the great help given our committee by Father Schwitalla, by the late Dr. Aaron Brown and by the chairman of the Phi Delta Epsilon Lectureship Committee, Dr. Leo Criep. Haskell Norman, consul of Alpha Pi Chapter and chairman of the local committee was ably assisted by the other members of his committee, whom he has already named, in working out the many details.

Father Holloran, to you as President of St. Louis University, and Father Schwitalla, to you as Dean of the School of Medicine, it is my privilege and honor as representing the Board of Trustees of Phi Delta Epsilon Fraternity and its constituent chapter, Alpha Pi of St. Louis University School of Medicine, to present you with the Hanau W. Loeb Lectureship.

May its purpose—the furtherance of medical education—be ever kept in mind.

ACCEPTANCE OF THE HANAU W. LOEB LECTURESHIP

PATRICK J. HOLLORAN, S.J., PRESIDENT
ST. LOUIS UNIVERSITY

It is with the deepest sincerity that I say it is a signal honor and a distinct privilege to receive this lectureship in the name of the University, since it is truly a treasure for which St. Louis University is doubly grateful.

All of us who have the University's interests genuinely at heart—members of the Administration, of the Faculty, of the Student Body—are grateful for the inspiration that this lectureship will assuredly be to future generations of medical students, recalling as it does one of medicine's and medical education's truly shining lights. We are all grateful, secondly, for herein a fitting honor is being paid to one to whom St. Louis University is indebted as it is to few other men—Doctor Hanau W. Loeb, an outstanding figure in the organization and first quarter of a century of sterling service rendered by our School of Medicine and the Dean of that School from 1913 until his death, July 6, 1927.

It is extremely gratifying to see all of Doctor Loeb's old friends here this evening, but particularly are we happy in having with us tonight his two distinguished brothers, Mr. Isidor Loeb and Doctor Virgil Loeb, and his charming and ever-gracious daughter, Mrs. Julian B. Cohn.

I should like very much to make gratitude the theme of the brief remarks I am privileged to make on this occasion. During the course of the dreadful world conflict that is now so sorely harrassing the peoples of the world, with a comfortng necessity we are marveling at the miracles which medicine is performing. We are witnessing human lives strafed with the cunning ingenuity of man's unbelievable inhumanity to man,—broken, bruised and painracked lives lovingly ministered to, restored to health, mended in limb and even in mind. We notice not only with grateful awe the achievements of medical science, but the heroism of unselfish and devoted service: the work of men who count not the hours nor reckon the danger, but whose sole concern is to bring to the wounded the full resources of their talents, their experience, their genuine charity, their very selves.

It is one of the fundamental axioms of sound philosophy that no effect exists without its adequate cause. I often wonder are many of us aware and, if aware, are we sufficiently grateful to those great

men who must be numbered among humanity's first benefactors, the men who have devoted their lives to the task of conferring upon the medical profession its grand endowments of learning, high ideals, service and charity. Should not this evening's gathering and the tribute it pays to Doctor Loeb be considered as a modest, yet cordial recognition of the large contribution that he has made to the professional knowledge and character of the thousands who have benefited by his tutelage and guidance? A man who is at one and the same time a great physician and a great medical educator must be a man possessed of learning and high ideals, as well as imbued with the spirit of noble service and genuine charity.

That Doctor Loeb possessed these four essential characteristics of his profession, we have not only the eloquent testimony of his countless friends and associates, but the incomparably more convincing testimony of the long list of medical students who received their instruction and training under his direction.

Justly is the learning of the medical profession held in the highest regard throughout the land. The application and study required for admission to its ranks surpasses that demanded by any other profession, with the sole possible exception of the priesthood, and the day by day conscientious inquiry and keeping abreast with the progress and developments of medicine make it imperative that the good physician never relinquish his student days.

The high ideals which actuate the career of medicine are not the product of accident or environment. Certainly they could hardly flow spontaneously from the character of our age. They are the result of rigorous discipline and the potent force of example—a discipline instilled and an example given efficaciously only by medical educators and practitioners of the type of Doctor Loeb.

Similarly, the fine quality of service which has ever been the cherished tradition of the practice of medicine could only be inspired by those imbued with the spirit of service that counts not the cost but regards only the objects of its ministrations and endeavors. It was here again that Doctor Loeb's words were of great effectiveness, but his example of incomparably greater eloquence.

Finally, the motive force that makes the true doctor a man of noble unselfishness is the recognition on his part that the work of his profession calls for an alleviation of human suffering, calls for a conferral of the inestimable benefits of health and soundness of body upon one created to the image and likeness of God. In a word, calls for a constant exercise of that fairest of all the virtues—charity.

One gifted with ordinary insight should not find it difficult to discover those factors which have principally contributed to the greatness of America. To my mind, two are more significant than all the others: the character of the American people and the natural resources with which God has blessed this land. The latter, it is true, we have used lavishly, but still have little more than scratched the surface. Of the former, however, what I like to refer to as the national character of America, I think it must be said of the many walks of life, we are living off the capital and not adding to this essential element of America's greatness. We have been allowing expediency and unselfishness to eat into our reserves and that as a people we shall suffer from this procedure is both obvious and inevitable.

It is principally in this relationship that it is wholesome and encouraging to see Doctor Hanau W. Loeb thus honored. He is highly representative of that profession which before all others has preserved inviolate its prominent position in America's greatness of character. He is more than representative; he has contributed his large share toward both the building up and the preservation of medicine's role in making America truly the world's most blessed land. I am convinced that his only desire in this signal honor being paid to his memory this evening would be that others would gather the inspiration and the courage to walk in his footsteps, bearing aloft that torch of learning, high ideals, unselfish service, and genuine charity that were not only an integral part of his life, but to which in fullest reality he had dedicated his life.

HANAU W. LOEB AND ST. LOUIS UNIVERSITY

ALPHONSE M. SCHWITALLA, S.J., DEAN,
ST. LOUIS UNIVERSITY SCHOOL OF MEDICINE

Dr. Loeb was fond of saying that his first introduction to the Jesuit and, therefore, to St. Louis University, came through Eugene Sue; and from Eugene Sue, he derived in the early years of college life, a cautious distrust of all that was Jesuitical. The story of his conversion from an attitude of cynicism to one of affectionate regard for all that is implied in the term "The Society of Jesus" is the story of Dr. Loeb's relation to St. Louis University.

When he first came into contact with Father William Banks Rogers in the latter days of 1902, Hanau W. Loeb was still the cauti-

ous assessor and the evaluating censor of the Jesuit. It was the candor, the frankness, the transparency of William Banks Rogers, then President of St. Louis University, that made Hanau W. Loeb suspect his own judgment concerning the Jesuit Order. Once he suspected the fallaciousness of his own judgment, he travelled fast from doubt to admiration, from hatred to love, from caution to precipitate devotion and by the time, scarcely a year after, when the documents were signed transferring the then Marion Sims-Beaumont College of Medicine to St. Louis University, Hanau W. Loeb, the Secretary of the Corporation, was the almost fanatical devotee of a move which even then required courage and determination to advocate. Within one year, he shifted from opposition to enthusiastic support of the decision reached by the Trustees of the old Marion Sims-Beaumont School.

He knew and met many Jesuits; he admired many but his deepest friendships with them were made with the strong; the strong Jesuit, the strong man among the Jesuits, these were the best of the friends whom he made among those who were prominent in St. Louis University in his day: the determined Rogers, the weighty Otten, the massive Frieden, the uncompromising Meyer, the persistent and indominatable Otting, the incisive McMenamy, the vigorous and comprehensive Burke. It is true that towards the end of his life, perhaps beginning at about the time of the World War, when he was passing the half century mark, he made a somewhat different class of friends and as of that date, we note the development of an almost affectionate regard between himself and the diplomatic and suave Charles H. Cloud, but during most of his life it was the man of power that attracted and held Hanau W. Loeb's attention and affection.

And what I have said of these Jesuits who have passed from our midst, I believe I could say of ever so many of his non-Jesuit friends, of whom it is more difficult to speak because so many of those to whom I should want to refer are, fortunately, still in our midst. What a story could be told concerning Loeb's relations with Bond and Lutz, Geiger and McCandless, Summa and Hypes, the older Dorsett and Chaddock, Witherspoon and Crandall, Nicholson and Brokaw, Starkloff and the older Hennerich, to mention only some of those who come spontaneously to one's mind. And then when the Board of Directors of the School of Medicine was formed, when Loeb and Father Rogers, the President, selected the men who would influence the trend of the new school of medicine, there were selected the powerful men of St. Louis history in the first decade of this century. To those of us who knew them at least by reputation when we were young, we shall never forget the veneration in which we held the names of Bakewell and

Broderick, of Church and Coleman, of Cupples and Drew, of Hirschberg and Kerens, of Nugent and Scullin, of Wade and Walker and Walsh and Whitelaw. These were the men whom Rogers and Loeb invited to be the contact men between the people of St. Louis and the School of Medicine of St. Louis University.

In the obituary, which it was my privilege to write after his death, I was bold enough to coin for Hanau W. Loeb a new word to describe what I still believe, after these many years in retrospect, to have been the secret of his life. He was a "kratophile," a lover and admirer, a worshipper of power. In that same obituary, I suggested that the motto of his life might well have been "Nike kai krate," "victory and power," the great motto of Aeschylus.

Power is the watchword which, I believe, explains, if anything does, the part which Hanau W. Loeb played in the development of the St. Louis University School of Medicine. After his graduation with the Doctor of Medicine degree from the old St. Joseph's College in 1887 and "ad eundem gradum"—a designation common enough in that older day when a person for one reason or another received the same degree from two institutions of learning—from Columbia University School of Medicine in 1888, he practiced privately for a short period of only three years before we find him receiving an appointment as Professor of Ear, Nose and Throat Diseases from the old Marion Sims College of Medicine. It was unthinkable that he should remain outside of administrative responsibilities for any length of time, and so within three years we find him becoming Secretary of the Governing Board of the Marion Sims College. He was one of the chief inspirers of the amalgamation of the Marion Sims College of Medicine with the Beaumont College of Medicine in 1901 and remained the Secretary of the amalgamated schools. But almost immediately, there began the negotiations with St. Louis University which two years after, in 1903, culminated in the purchase of the combined Marion Sims-Beaumont College of Medicine by St. Louis University. Once those negotiations had progressed to the point of understanding things moved rapidly. As Dr. Loeb himself told me on one occasion, one of the proudest days of his life, perhaps the proudest day, was April 25, 1903, when the senior class of the Marion Sims-Beaumont College of Medicine graduated as the first graduating class of the Medical Department (as it was then called) of the St. Louis University. With what pride he issued the first catalogue of the new school. With what care he selected the pictures and established the format of the new catalogue. How careful he was to introduce into this new catalogue the history of St. Louis University. He, it was, with Father Rogers, to

be sure, who boasted of bringing together the entire equipment of the combined schools, of consolidating the faculties of both institutions; he boasted of the wider range of instruction; he heralded to the world the sentence which at that time, fully twelve years before the Flexner Report, became the watchword of medical education, "It is universally admitted that medical teaching to be effective must be placed upon an university basis and that only by the influence of an university can the requisite details necessary for medical instruction be secured." He had printed in that catalogue the pictures of those venerable and time-tried hospitals which have stood by St. Louis University from the days of the infancy of the School of Medicine to this day of the University's might. Old St. Ann's, St. John's, the Alexian Brother's, Mount St. Rose and St. Mary's Infirmary, all of these institutions—St. Anthony's came somewhat later—made their first public appearance in that year in an university organization and in an university publication.

It would lead us too far to trace the influence which two strong-headed but large-minded and larger-hearted men had one upon the other in the days of Elias P. Lyon's deanship. For almost ten years, Elias P. Lyon wrote the policies of the new school of medicine but he was wise enough to know that preceding the writing of policies, there must be hours of study and planning. And so we find, in the minutes of the Administrative Board in that far off day, the discussions and the arguments that enabled the large vision of Elias P. Lyon supplemented by the wisdom of a Loeb, the determination of an Eycleshymer and the diplomacy of a Neilson, to fashion the development, during the first decade of the school, which is today a source of pride to St. Louis University.

The University passed through a dark night when within a few months of each other Lyon became Dean of the University of Minnesota and Eycleshymer, of the University of Illinois Schools of Medicine. Father Burroughs was President of the University for a short period; Father Burke was Regent of the School of Medicine and both looked to Hanau W. Loeb as the one who thence should lead the School. It was a courageous decision which the Trustess made, courageous for many reasons but a significant decision and one which was heralded not only locally but nationally as indicative of the spirit of St. Louis University. Yes, the decision was applauded but it was also misunderstood. It was misunderstood by those who at one extreme of the scale spoke of the indifference to fundamentals in "some Catholic institutions," and at the other end of the scale, it was misunderstood by those who saw in the appointment an effort to amalgamate,

in an educational venture, two minorities with the purpose of strengthening both. But vigorously, courageously and determinately Dr. Loeb took the problem in hand. Within a year of the assumption of his deanship in 1913, the School was inspected and Flexner's inspection vindicated the policies of Lyon and Loeb and Burke and Rogers and pronounced the School a marvel of financial and educational efficiency in view of the financial inadequacies under which the School was laboring Nothing daunted, Dr. Loeb carried out his propaganda for the School; his visits to New York; his battling with the Foundations; his repeated efforts to secure large funds; his collaboration with Father Burke in calling the attention of St. Louisans to the importance of this School through the epoch-making editorial in the St. Louis Mirror from the pen of the unforgettable Marion Ready; his participation in the medical and professional societies of the nation; his strong advocacy of advanced standards of medical education in the Association of American Medical Colleges; his ability to gather around him the men who have done so much to make St. Louis University School of Medicine what it is today—Joseph and Auer and Doisy and Kuntz and Kinsella and Coughlin and Gellhorn and Dolley and Fleisher and Pohlman and Zahorsky and Grindon and ever so many others—all these activities and countless others were crowded into only fourteen years, into scarcely more than a decade, but a decade of almost incredible growth of the St. Louis University School of Medicine.

At the same time, the development of his specialty occupied his attention. The World War took him back and forth across the country. He wrote his two volume manual on Otolaryngology; he wrote the Army Manual on his own specialty; he organized the Board of Otolaryngology; he developed and edited the Annals of Otology, Rhinology & Laryngology; he carried on an extensive office practice; he participated in the development of the hospital system which St. Louis University is still using for its clinical teaching; he served on the boards of several of the hospitals; he was particularly active in the Jewish Hospital; he was a public-spirited citizen and showed his spirit by extensive participation in civic activities; he took a large part in the planning of the present medical building; all of this meant for him the joy of creation, the pleasure of tremendous work, the ecstasy of a huge self-stimulated activity and for him, it all meant an increase in that which he loved, a sense of power.

No, I would not be understood as implying that the love of power was for Hanau W. Loeb an exclusive motivation. Power for him was a means to an end. The human side of life, the capacity to

serve others, the desire to achieve human betterment, this was for Hanau W. Loeb the motive for his huge expenditure of himself. He was a believer in God, child-like, simple, trusting, confident. He loved the traditions of his race; he was proud to refer to himself as a prophet and he said jokingly but with a deep appreciation of the truth, that only a Jew can be a prophet.

He was strong even in his last illness and in his death. The largeness of personality that was so characteristic of him never left him even in death. He was still the administrator, the leader of men even during those months which he spent in the southeast corner of the old Jewish Hospial and where many a one of his friends still found inspiration and advice at a time when his heart disease had progressed beyond a critical stage, for even to the last he planned and projected, he studied and made programs and even the day before his death, he discussed the details of the next year's budget.

He was my predecessor in office; I glory in the traditions which he established. Fifty years ago this year, I entered St. Louis University as a high school student. The University has given me all I have today but I am happy that in this year which for me is so much of a reminder of what I owe to St. Louis University, I am able to contribute this mite to the life of my Alma Mater. I am happy that I can be instrumental in dedicating to St. Louis University and especially to its School of Medicine, the memory of one who was to me a strong friend, a powerful leader, a mighty inspiration. I thank Phi Delta Epsilon for having given me the chance to pay this tribute to the memory of Hanau W. Loeb.

Notices

UNIVERSITY OF ILLINOIS

The University of Illinois College of Medicine will give a special course in Broncho-Esophagology under the direction of Dr. Paul Holinger, October 15-27, inclusive, 1945. This course will consist of didactic lectures, animal and cadaver demonstrations, practice in bronchoscopy and esophagoscopy, and diagnostic and surgical clinics; and will be limited to twelve physicians. For further information address: Department of Otolaryngology, University of Illinois College of Medicine, 1853 West Polk Street, Chicago 12, Illinois.

AMERICAN BOARD OF OTOLARYNGOLOGY

The Chicago meeting of the American Board of Otolaryngology scheduled to be held in October 1945 has been cancelled.

OFFICERS

OF THE

NATIONAL OTOLARYNGOLOGICAL SOCIETIES

American Academy of Ophthalmology and Otolaryngology

President: Dr. Gordon B. New, Mayo Clinic, Rochester, Minn.
President-Elect: Dr. Alan C. Woods, Johns Hopkins Hospital, Baltimore, Md.
Executive Secretary: Dr. William L. Benedict, Mayo Clinic, Rochester, Minn.
Meeting: Cancelled.

American Broncho-Esophagological Association

President: Dr. Carlos E. Pitkin, Carnegie Medical Bldg., Cleveland, Ohio
Secretary: Dr. Paul Holinger, 700 N. Michigan Ave., Chicago 11, Ill.
Meeting: Cancelled

American Laryngological Association

President: Dr. Harold I. Lillie, Mayo Clinic, Rochester, Minn.
Secretary: Dr. Arthur W. Proetz, Beaumont Bldg., St. Louis 8, Mo.
Meeting: Cancelled

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Albert C. Furstenberg, University Hospital, Ann Arbor, Mich.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Meeting: Cancelled

Sections:

Eastern—Chairman: Dr. Oram R. Kline, 414 Cooper St., Camden, N. J.
Southern—Chairman: Dr. Verling K. Hart, 106 W. 7th St., Charlotte, N. C.
Middle—Chairman: Dr. Carl H. McCaskey, 608 Guaranty Bldg., Indianapolis, Ind.
Western—Chairman: Dr. Aubrey G. Rawlins, 384 Post St., San Francisco, Cal.

American Medical Association, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Louis H. Clerf, 1530 Locust St., Philadelphia 2, Pa.
Secretary: Dr. Fletcher D. Woodward, 104 E. Market St., Charlottesville, Va.
Meeting: Cancelled

American Otological Society

President: Dr. Gordon Berry, 36 Pleasant St., Worcester, Mass.
Secretary: Dr. Isidore Friesner, 101 E. 73rd St., New York, N. Y.
Meeting: Cancelled